This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

1837
ARTES
VERITAS
SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
E PLURIBUS UNUM
TUEBOR
SI QUAERIS PENINSULAM AMOENAM
CIRCUMSPICE

[illegible] 11-12

T
1
.F8

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED
BY THOMAS P. JONES, M. D.

MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY, AND OF THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA, PROFESSOR OF CHEMISTRY IN THE MEDICAL DEPARTMENT OF THE COLUMBIAN COLLEGE, AND LATE PROFESSOR OF MECHANICS IN THE FRANKLIN INSTITUTE, AND SUPERINTENDENT OF THE PATENT OFFICE AT WASHINGTON.

VOL. VII.

NEW SERIES.

PHILADELPHIA:
PUBLISHED BY THE FRANKLIN INSTITUTE, AT THEIR HALL;
THOMPSON & HOMANS, WASHINGTON CITY; G. & C. & H. CARVILL, NEW YORK;
AND MONROE & FRANCIS, BOSTON.
J. HARDING, PRINTER.

1831

Engin. Library
T
1
.F834j

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JANUARY, 1831.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1830.

With Remarks and Exemplifications, by the Editor.

[Concluded from page 376 of vol. vi.]

44. For an improved *Smut Machine*, for hulling, smutting, and cleaning grain; Jeremiah Cose, Sodus, Wayne county, New York, October 1.

The grain to be cleaned by this machine is, in the first instance, made to fall from the shoe of the hopper into a riddle, and thence into a smut wheel, which is a wheel of fifteen inches in diameter, and three inches deep; this wheel has an eye of six inches diameter, made like that of a mill stone. The smut wheel is furnished on the under side with a sheet iron grater, or with points of iron, and runs upon a circular bed of sheet iron of the same diameter, and perforated with small holes. The grain passes between the scouring wheel and bed, and runs over eight small screens within the curb inclosing the wheel; thence it falls by a small opening through an air channel, into the eye of the stone. In its passage it is acted upon by an air wheel, or fan, to which the requisite motion is to be given, as well as to the smut, or scouring wheel.

There is no claim to any part of the machine.

---

45. For an improvement in the *Making of Pepper and Ink Tops;* William Markland, City of New York, October 1.

This patent is taken for raising the tops of ink stands, or pepper boxes, out of one piece of metal, instead of by soldering, or grooving two pieces together. The raising is to be effected in any of the presses commonly used for such purposes, and we are informed that the tops may be ornamented, by means of beading rollers, which beading rollers consist of a male and female roller, between which the raised tops may be placed, and the bead, or other ornament raised upon them.

The claim is to "the making or manufacturing of *pepper* and *ink tops*, from one entire piece."

It is possible that the making of pepper and ink tops in this way, may not have been practised, but tops for canes, and many similar articles, have been so made. There is nothing new in giving to metal the form proposed, by the means pointed out in the specification, nor is it pretended that such is the case; the patent, therefore, must rest upon the exclusive application of the raised metal, to pepper and ink tops.

---

46. For a *Thrashing Machine;* William Ottinger, Whitemarsh, Montgomery county, Pennsylvania, October 1.

We think it unnecessary to describe this machine, as it wears the uniform of the regiment to which it belongs, and if there is any difference in its accoutrements, these are not specified in its commission. The whole machine, with its cylinder, beaters, and hollow segment, is described, but no claim made.

---

47. For an improvement in the *Construction of Hair Mattresses;* William F. Phyfe, City of New York, October 1.

These mattresses are to be stuffed with three or more distinct layers of hair, between which canvass extends from side to side, and is secured to the ticking which forms the borders of the mattress. The specification contains directions for stuffing the mattresses between the different cloths, and the manner of tying the strings which are to retain the stuffing in its proper place.

---

48. For a *Rotary Steam Engine;* Thomas Powell, Baltimore, Maryland, October 1.

Instead of being for a rotary engine, as stated in the petition and specification, the patent is taken for dispensing with the crank in the ordinary reciprocating engine. The mode in which this is proposed to be done, is altogether without the recommendation of novelty. A rack upon the piston rod, is to work into cog wheels furnished with ratchets,* in a way familiar to every one acquainted with the history of the abortive attempts which have been made to improve the steam engine.

The patentee informs us that "this engine *promises* to supersede all others, for simplicity of construction; for power obtained by a full action of the steam on the extreme periphery of the wheel; for power saved by reducing the friction, caused by the machinery necessary to keep up the action of the crank; for *gaining the loss of power* in the crank approaching to, and receding from, the dead points; and for doing away a large body of machinery, thereby simplifying the machine, and greatly reducing the expense."

We are of opinion that this promising machine will not falsify the old adage, that "quick promisers are slow performers." The same kind of machinery has made precisely the same promises to a large number of previous projectors, and has never yet redeemed its word. We, who know this, have no confidence in it on the present occasion.

---

49. For a machine for *Drilling Rocks for Blasting;* John W. Post, Washington City, October 1.

This machine consists of the drill ordinarily used for the purpose of drilling rocks, but it is to be supported by a frame, standing upon four legs. It is to slide up and down through holes in the cross bars of this frame. The drill is attached to a double bow spring, at its upper part, and is to be loaded with a weight, should its own weight be too small. The drill is to be forced down by the hand in the usual way, and raised by the elasticity of the spring. The claim of the patentee is to "the use of the spring, constructed as above described, and the form of the rod, and its connexion with the spring; or whatever may prove to be original or novel, in the above description."

It is no uncommon error on the part of patentees, to suppose that after they have claimed certain specific things, they have a contingent remainder in certain others which may hereafter prove to be new: but who is to find out the novelty, if the inventor cannot? It is his business to inscribe *nole me tangere* on the part which he patents, and if he cannot tell where to place the label, he may rest assured that others have no interest in making the discovery.

---

50. For a *Machine for Cutting Straw;* Titus Preston, Wallingford, New Haven county, Connecticut, October 1.

The description of this machine is of considerable length, entering into a minute description of all its parts, both new and old. Its general structure is similar to many long known straw cutters. The specification ends as follows.

"I do not, however, claim the whole machine herein described, as my invention. But I do claim as my invention and improvement, the feeding box, and its appendages, particularly the rack and screw wheel, as above described. The gate with its several appendages, and the mode herein described for fastening the plank upon the shaft; and the screws to regulate the knife. And for these, jointly and severally, I claim an exclusive right."

The cutter is a curved revolving knife, fastened to a plank by means of screws, with check screws to set it at the proper distance from the plank. The mode of doing this, it will be seen, is claimed; this mode, however, is well known to every machinist. The straw is drawn forward by an endless screw cut upon the back end of the

"What I claim as new, and as my own invention, is,"

"First, the application of the finger lever directly to the foot of the connecting rod, dispensing with the jack, springs, and all intermediate gearing. By this more immediate operation of the finger lever on the hammer, no time is lost between the touch and the blow; the action is more controllable by the finger; the blow is quicker and more powerful; the hammer can never block; it relieves less from the string; and requires much less depth of touch. The simplicity of its construction renders the work much cheaper, and less liable to get out of order than any known action."

"From this perfection of the action I have been able to render the span of the natural action to six and a half inches, and the others in proportion, without in any degree interfering with a clear and rapid execution. Or the common span of the octave may be retained."

"Second, the placing the dampers below the hammer rail, by which position the dampers fall on the brass strings nearer the middle of them, and thus more instantaneously and effectually stop their vibration, and may be raised by the simpler and cheaper modes herein before specified."

---

57. For *Manufacturing Hat Bodies by Machinery;* Henry Tenny, Plattsburgh, Clinton county, New York, October 1.

This is another variation of the machines for forming hat bodies from a fleece taken directly from the carding machine. The wool is received, as in others, on a revolving apron, passed round rollers. The principal difference between it and some others, is, that the revolving apron passes over a roller which is large at each end, and small in the middle, just the reverse of the double conical formers upon which the wool is to be eventually rolled. The apron is made sufficiently loose to swag, so as to pass into the hollow of the concave roller. Behind this roller the double conical former is laid upon the apron, and as this moves round the hat former receives a wabbling motion, crossing the wool in the way required.

We are told that this is an improvement, but in what part of the arrangements the improvement consists, no information is given. Many parts of the machinery resemble others used for the same purpose; the portion which is new may probably be valuable, but the fatal and common error of not pointing it out, is again committed.

---

58. For *Preparing Clay for Making Brick;* Jared G. Falcott, Glastonburgh, Hartford county, Connecticut, October 1.

(See specification.)

---

59. For a *Double Dasher Churn;* William Sutton, Geneva, Ontario county, New York, October 1.

This is a new patent for an old machine, which we have more than once had occasion to describe. Two vertical shafts are made to revolve, each carrying dashers, which pass in the spaces between the dashers of its fellow. The whole is clearly represented in the drawing, but there is no claim.

---

60. For a *Machine for the Purpose of Raising Water and Acquiring Power;* Theophilus Somerby, Nantucket, Massachusetts, October 1.

To any one having the slightest claim to the name of machinist, or to any one acquainted with the elementary principles of motion, no more need be said, than that the plan proposed is to raise water by the action of the tide or current upon a small float wheel. The water is to be raised in buckets, similar to the hopper boys, used in flour mills; which water is afterwards to be employed in driving machinery.

The patentee probably expects to cheat the water out of a portion of its gravity, by coaxing it up an inclined plane, instead of raising it vertically. Should he succeed in doing this, there will be something new in his *invention.* We dare not add useful, because we are not quite certain that we should derive any advantage from abrogating the laws of nature.

---

61. For *Machinery for Boring and Mortising;* Marcellus Sands, Franklin, Delaware county, New York, October 1.

This machinery is intended for boring and mortising hubs, and other articles. It is well represented and described in the drawing and specification. There is no claim made, and as the arrangement of the parts differ considerably from the machines previously patented for similar purposes, it is probably considered that the whole is new. Without the drawing, a description would not be intelligible.

---

62. For a *Baking Iron, for the purpose of Baking, Toasting, or Boiling;* Elijah Skinner, Sandwich, Strafford, county, New Hampshire, October 1.

This is an affair made of sheet iron, and in form something like a cheese *toaster.* Its principal merit and *novelty* consists in its being more cheaply made than a tin kitchen. "What I consider as new," says the patentee, "and my own invention, is the construction of the instrument as described in the specification, cheap, and easy made, varying from a tin kitchen and boiler, so that one cheap instrument may supply the place of a cake block, toast iron, gridiron, and broiler."

---

63. For a *Thrashing and Winnowing Machine;* Samuel Slater, Northern Liberties, Philadelphia county, Pennsylvania, October 1.

We will let the patentee tell for himself the improvements which he has made. After describing his machine, which we should be in danger of confounding with some others, he says, "the difference between the plan and operation of this thrashing and winnowing, or cleaning machine, consists in this, that is to say; in the first place, the machine is constructed with a board flooring instead of a cloth apron, which is now used. The board flooring answers the purpose much better than the revolving apron, and is at the same time less expensive, and not liable to want repairing; or to being injured. 2nd. The beater revolving or throwing the dust from the person attending the machine, which is not the case in any former invention. 3d. The simplicity of the concave. 4th. The fan, the wind coming in contact with the beater, which prevents the straw from tangling. 5th. The whole machine is more simple, and precise in its operations, much better calculated for the farmer than any now in use, durable, and easily constructed, the price considerably less than others, which afford no competition with the above described. 6th. The machine is also admirably calculated for thrashing rice."

The foregoing novelties, are some of them old, and others intangible. The board flooring has been long and frequently employed. The beater throwing the dust from the person has been used in former machines. With respect to the cheapness, and other desirable properties of that kind, we have nothing to say, and will only add a curious kind of claim, which also belongs to the intangibles, "*the claims are the general merits of the machine.*"

---

64. For a *Mode of Straightening the Splits or Dents for Weavers' Reeds,* by the application of heat; Jacob Senneff, City of Philadelphia, October 1.

(See specification.)

---

65. For a *Thrashing Machine;* William Sperry, City of New York, October 1.

A cylinder and concave segment are to perform the work of thrashing. The cylinder is to be made of one solid piece of timber, driven full of flat spikes. These are to project about one inch from the wood, and to stand "diagonally each way." The concave segment is to be formed of any number of *slabs,* fluted lengthwise.

These are the particulars claimed; but we do not know by which of these features it is distinguished from other thrashing machines.

---

66. For a mode of *Applying Power for Propelling Thrashing Machines,* turning lathes, furnaces, cider mills, or any such machinery; Augustus Sawyer, Hopewell, Ontario county, New York, October 1.

This is one of those contrivances in which, by multiplying the moving parts of a machine, those who have no solid knowledge of mechanics succeed in cheating themselves and others into a belief that they have made a discovery.

A horse is to turn a shaft, carrying a horizontal wheel, in the manner of the common horse.mill. The cogs of this large wheel are to mesh into a trundle head; on the shaft of this trundle head there is to be a horizontal screw, of wood or metal. The threads of this endless screw are to turn a perpendicular cog wheel: on the shaft of this is to be another cog wheel; this last wheel is to turn "a large band *wheel*, which by means of a band attached, plies a small wheel with a *great* increase of *velocity*. To the axle of this latter is at*tached* the machine necessary to be put in motion."

We have no doubt that this machinery will be as useful in "pro*pelling* furnaces," as in its application to any other purpose.

---

67. For an improvement in the *Carding Machine;* Uriel Warner, Ripley, Brown county, Ohio, October 1.

We do not very well understand the description of this improvement. The object is to work the comb, in the operation of doffing, by a new arrangement of the parts which give it motion. This it is said to do more steadily, and with less power than the common method.

---

68. For an improved *Water Wheel for Propelling Mills;* Clark Willson, Swanzey, Cheshire county, New Hampshire, *October 1.*

A vertical shaft is to be supported by suitable gudgeons. At the lower end of this shaft, there are bucket boards of wood, or other material, which bucket boards are let into the shaft, and are surrounded by a rim. Some idea of the form of this wheel may be obtained, by supposing the leaves of a smoke jack wheel to have a rim extending from face to face. On the upper face of the wheel the buckets have less inclination than at a distance from it, and are so curved, that on the lower side, where the water makes its exit, they are nearly horizontal. "The application of the water to the wheel may be by placing the wheel in the base of the floom, and giving the bulk of water free access to drop into and vent from the spiracles."

"The advantages of this wheel are the saving of a large portion of water; the omission in most instances of gearings in mills, &c.; the cheapness of building and repairing, and the free and uninterrupted operation of the wheel in flood water," &c. &c.

The mode of applying this wheel is very imperfectly described, the whole of the directions being comprised in the part above quoted. The claim is to "the particular form of the spiracles, [buckets,] or ventways, and the manner of applying the water to them."

---

69. For a machine for *Thrashing Grain;* William J. Wood, Batavia, Genesee county, New York, October 1.

We opened the specification of this patent with the expectation of seeing another cylinder, and hollow segment, but found a machine new in its form, whether superior or not in its operation, we are not prepared to say.

Suppose a wheel, with spokes, like a coach wheel, and another of only a few inches in diameter, to be connected together by an axis. These wheels, if rolled round on a floor, would pass round a point, in the manner of a cone. From the barn floor, on which the grain is to be thrashed, rises a vertical shaft, to which the axis is attached, at the end bearing the small wheel, or at the apex of the supposed cone. To a sweep from this shaft a horse may be attached, and the machine drawn round. The flails are formed of plank, and are as numerous as the spokes of the wheel, which in the drawing amount to 18. They rest against the spokes by their flat sides, their edges standing towards the rim and hub; they extend from wheel to wheel, being attached to the smaller wheel by pins, or otherwise, forming a moveable joint upon which they play. At the other end they are kept in their places by the rim and spokes of the large wheel. The levers, or flails on the upper side of the machine, rest upon the hub, but fall by their gravity, as it rolls round, and strike upon the wheat, or other grain upon the floor. The claim is to the application of power in this way, for the purpose of thrashing.

We should be apprehensive that these flails would not fall upon the straw with sufficient force, or directness, to accomplish the purpose intended.

70. For an improvement in the *Construction of Saw Mills;* Joseph Newton, Sweden, Monroe county, New York, October 1.

The improvement proposed, is, to have teeth on both edges of a saw, and to construct the mill in such a manner that the log may be sawed in passing either way. There are to be two rag wheels, and two feed hands, operating in reversed directions.

We much doubt whether the advantages derived from this mode, in ordinary sawing, will compensate for its inconveniences. The plank must be cut entirely off, whilst in the ordinary mill they support each other until the last slab is taken off. If any mode of obviating this objection has been devised, it has not been presented to us by the patentee.

71. For a *Hinge and Plain Stock,* for gentlemen's wear; Denison Williams, Albany, New York, October 1.

"Said improvement consists in making the hinge stock of different descriptions of fur and of hair seal skins, with an approved and new composition foundation consisting of hair or bristles, or either of them, supported by prepared elastic linen."

There is no drawing of the proposed stock, and the foregoing is the whole description; and if it is given "in full, clear, and exact terms," we know not what is deficient, obscure, and indefinite.

72. For a *Machine for Cleaning Grain;* Michael Urffer, Upper Milford, Lehigh county, Pennsylvania, October 1.

The general form of this instrument is that of the Dutch wheat fan. Instead of the ordinary screens, or sieves, there is a cylindrical revolving sifter, working something like a bolter, the grain passing in at one end, and out of the other, on to the inclined board, where the fan operates upon it. This is the principal alteration from the common arrangement.

---

73. For an improvement in the *Hemp and Flax Dresser;* Ethan H. Nichols, of Hardwick, and Thaddeus Fairbanks, of St. Johnsbury, Caledonia county, Vermont, October 1.

The machine used is that constructed by Hines and Baine, and the improvement claimed is for pairs of rollers to be used with it, which the patentees call *dressers.*

These rollers have iron beaters extending from end to end, like the cogs of wheels; they are placed in pairs, with the leaves of one roller mashing between those of the corresponding roller.

This plan bears a very near resemblance to others which we have formerly noticed.

---

74. For a *Churn,* called the "Float Wheel Churn;" Ebenezer Deevey, Butternuts, Otsego county, New York, October 1.

This is a sort of barrel churn, with an axis passing through it, having dashers placed upon it obliquely, and in reversed directions.

---

75. For an improved *System of Procedure in the Drying and Curing of Tobacco;* Davis G. Tuck, M. D. Halifax Court House, Virginia, October 1.

The system proposed is founded upon the principle, that in order to preserve the valuable qualities of vegetable substances, which are to be desiccated, the process ought to be effected within a limited time, in order to prevent spontaneous decomposition; and that to effect this, the operation must be carried on at temperatures within the absolute control of the operator. The whole arrangement proposed by the patentee, is sufficiently simple to be carried into effect by ordinary hands; the principles upon which it is based, are obviously true, and the test of actual experiment has evinced its great value. We shall hereafter give an epitome of the specification, which is of considerable length.

---

76. For *Wire Eyed Cast Buttons;* T. Festus Hayden, Waterbury, New Haven county, Connecticut, October 1.

The following is the substantive part of the specification.

"The wire eyed cast buttons for coat, vest, or other use, is made, stamped according to fancy, burnished and edged in the usual manner, and fitted to receive the cap, or shell, or rim required, which is prepared from the same materials, and put on and closed down in the same manner as is usually done on buttons with soldered eyes. "The wire eyed *cast* buttons may be prepared for inlaid work by an indentation in the face by a suitable stamp or die; or by a projection in the face of the mould, or by raising the edge by passing through dies calculated for that object: when thus prepared, any fancy work of brass, or other ornamental metal, may be inserted and fixed in its place by the burnisher, or by a stamp with ornamental devices impressed upon the raised edge."

"I do not claim as my invention the method of making the wire eyed *cast* button. This has long been known and used: nor do I claim as any part of my invention, the method of making or preparing the cap, shell, rim, inlaid, or other ornamental work, attached to the face of other buttons as now known and used; but I do claim as my invention and improvement, the application thereof to the wire eyed *cast* button as above described."

---

77. For an improvement in the art of *Manufacturing Malleable Iron from Pig Metal;* Thomas Cotton Lewis, Pine Creek, Alleghany county, Pennsylvania, October 1.

(See specification.)

---

78. For *A Cylindrical Grate Cotton Whipper;* James S. Simmons, Scituate, Providence county, Rhode Island, October 1.

This cotton whipper consists of a cylindrical grate placed vertically, and inclosed in a wooden box. A shaft passes down through the centre of the cylindrical grate. Arms project from this vertical shaft, and others called fingers, project from the interior of the cylinder, in such a manner, that when the shaft is made to revolve, its projecting arms may pass between those on the cylinder.

The cotton is fed into the cylinder, where, by the rapid motion of the shaft, it is beaten and opened; the seeds and other foreign matter being principally driven out through the grating of the cylinder. There is, of course, a suitable opening for the delivery of the cotton.

The claim is to the cylindrical grate; to the fingers inserted within the grate, or cylinder; and to the shaft passing through the cylinder, and having two, three, or more arms inserted in it.

---

79. For an improvement in the *Mode of Manufacturing Combs;* James Pitts and Cyrus Houghton, of Lancaster, Worcester county, Massachusetts, and Joseph Rice, Jr. of Scituate, Rhode Island, October 1.

This patent is for "a machine for grinding comb stocks, and making combs."

"This improvement consists in several things. *First,* in grinding or preparing the stock for combs, doing that part of the work by machinery, which hitherto has usually been done by hand. *Second,* in a better method for smoothing the teeth from the back, or quill of the comb, to the end of the teeth. *Third,* in a better method of pointing, or rounding the teeth."

A common coarse grit grindstone is used to reduce the horn, &c. to a proper surface, there being under the stone a suitable support and slide to hold and manage the pieces to be so ground; water is to be allowed to run upon the stone during the operation.

The ends of the teeth, and the rough ends of cut combs, are also to be smoothed by grinding. A third stone, with grooves on its face, is used to smooth the teeth. The stones in the two latter cases are to be used dry. The claim is to the *process of grinding* in the manufacturing of combs.

---

80. For *A Churn;* Samuel M. Parsons and Sereno Dickerman, both of Meriden, New Haven county, Connecticut, October 1.

A very formidable specification introduces us to an acquaintance with this churn. The dimensions of every part is given with great precision, and the final claim is to "the combination of the various parts of the machine in the manner aforesaid, to produce the compound motion, and thereby the result."

The trough to contain the cream is semi-cylindrical; above which there is a shaft, to which the dasher is affixed, and the lever by which it is to be worked; this lever being acted upon by hand, causes the dasher to vibrate in the trough.

---

81. For a *Circular Car Receiver;* Jonathan Crane, of the City of Schenectady, New York, October 1.

We are informed that "the utility of the circular car receiver, consists mainly in the facility which it affords in removing the car, or other vehicle, from one rail to the other. It is believed that important advantages will be derived from its use in removing ponderous bodies of earth from hills into vallies, and that it can be applied with great advantage in graduating for rail-roads; and at the termination of rail-ways, in removing the car, or other vehicle, when loaded or empty, from one rail [track] to the other, whether the rail-ways are parallel, or at right angles."

The principal object of the patentee appears to be to aid in the construction of rail-roads, where embankments are to be made. Suppose a double track to be laid along the embankment so far as it is completed; these tracks are to be connected together by means of a semicircular platform, which is placed a little below the level of the rails. A carriage, upon rollers, is adapted to this platform, which carriage is of such a height as just to reach the level of the rails. A lever, or sweep, is attached to this carriage, for the purpose of carrying it round from one track to the other; this it accomplishes by its working on a pin, or fulcrum, placed between the two tracks, and in the centre of the curved platform. A car, bringing earth, is received upon this carriage, and by means of the lever, it may be carried round so as to return by the other track; and a succession of cars may thus be employed, without their interfering with each other. The earth, or other material brought, may be shot down, or unloaded, whilst the car is on the circular platform, or in any required part of its journey.

82. For an improvement in the *Spinning Machine;* William Clark Pultney, Steuben county, New York, October 1.

It is some time since we have had before us any of those domestic spinners, which in former times were made the subject of patents in considerable numbers. The reduced price at which the products of our manufactories are now afforded, renders it doubtful whether machines of this description can be advantageously used in many situations. But few of those which have been patented, have any claim to originality of invention; it is only upon the particular arrangement of the parts, *if upon any thing*, that a claim could be sustained. The machine above named does not possess any novelty which we can perceive; and upon this subject the patentee has not attempted to enlighten us, as he merely describes his machine, of which he has furnished a very indifferent drawing, without claiming any part as his invention.

---

83. For sundry improvements in a *Printing Machine*, called a Power Printing Press; Isaac Adams, Boston, Massachusetts, October 4.

We cannot pretend to give any description of this machine, which, in the specification, occupies ten pages, and is accompanied by large and complicated drawings. The points claimed, are, "the combination of stationary fly frames, with points for getting register by, on them, with printing presses."

"The object of these fly frames, is, to enable the person who lays on the paper to point one sheet, while the sheet previously put on is receiving the impression, and by that means save the time which would be lost in waiting for a frisket to come out."

An apparatus for giving a periodical movement to the rollers and friskets, as described in the specification, and the use of what the patentee calls declension levers, are also claimed.

---

84. For a *Vibrating Flour and Powder Separating Machine;* Benjamin Culver, Glastonbury, Hartford county, Connecticut, October 6.

This apparatus consists of several sieves placed one over the other, increasing in fineness as they descend. The sieves are to be suspended by leather straps, which allow a vibrating motion to be given to them. The contents of each sieve is to be discharged upon a separate, inclined board, and thus conducted to its proper receptacle. The patentee says, "what I claim as my own invention in the aforesaid machine, is the whole of it as applicable in the manner above specified."

As sifters of the kind above described have been long known and used, in several different manufactories, we are of opinion that the claim to the whole machine is altogether unfounded. It is a principle well established in law, that the taking a known machine, and operating by it upon a material to which it had not been previously applied, is not an invention, or discovery, such as to entitle any one to an exclusive right.

If the sifting machine was not *invented* by the present patentee, it was no *discovery* that flour and powder, as well as drugs, and other pulverized articles, might be sifted by it.

---

85. For an improvement in the *Construction of Saw and Grist Mills;* William Prim, Lebanon, Wilson county, Tennessee, October 6.

The proposed improvement consists in the application of spiral wheels to saw and grist mills. When used for a saw mill, the spiral wheel is to be placed with its axis standing horizontally; the wheel running in a trough, or curb, into one end of which the water enters from a penstock. The pitman is to be attached to a crank on the shaft of the wheel. When used for a grist mill, the shaft is to stand vertically, with the stone placed as in the common tub mill. The claim is to the mode of applying the spiral wheel.

The patentee avers that a wheel of this description may be driven with one-third of the quantity of water necessary to wheels of other constructions. We are of opinion that those wheels with which the *spiral wheel* has been compared must have been of a very indifferent kind, as we know of no plan much better calculated to lose power than those water wheels which act on the spiral principle.

---

86. For an improvement in the *Springs of Carriages, and in the method of attaching the Bodies of Carriages to the Springs;* Joseph Ives and James Walters, Brooklyn, Kings county, New York, October 6.

The springs used by the patentees, are straight springs attached to the perch, or other frame work of the carriage. They extend out in a line with the carriage before and behind, being horizontally, and being bolted down at their inner ends. To their outer ends a rope, chain, or band, is attached, which rises up, and passes over a pulley, to which the other end of the rope, chain, or band, is fastened. The pulley is fixed upon a shaft, the gudgeons of which turn in two standards, framed in the carriage for that purpose. Other pulleys are fixed on the ends of the shaft, from which ropes, chains, or bands extend, and are attached to the body of the carriage.

When the body is hung, its weight tends to turn the pulley, to which it is attached by the ropes or bands, and in doing so the pulley connected with the springs raise them from the frame work on which they rest.

The claim is to this manner of suspending carriages.

---

87. For an improvement in the manner of *Constructing Bands for Carriage Hubs;* Samuel K. Miller, Elizabethtown, Essex county, New Jersey, October 7.

The whole description is comprised in the following words.

"The band consists of an iron or copper ring, on to which the beard, cap, or moulding of brass, or other metal or metals is cast, soldered, or fastened by other means. The extent of your petitioner's claim is the iron or copper ring when attached to, or finished with other metal as above described, whereby much greater strength is produced with less weight and bulk than those now in use, of entire brass: on which rests your petitioner's claim."

---

88. For *Machinery for Dressing Staves;* William Thomas, Pomfret, Chautauque county, New York, October 7.

The description of this machinery has the same happy brevity with the last mentioned invention: it is as follows.

"The reacting stave dresser consists of two half circles, connected so as to let the stave pass between them, with two or more knives attached to them, so as to dress the stave on the outside and inside at the same time, the knives cutting both ways. The stave is made fast at both ends by dogs, which are attached to a carriage that passes outside of the circles. The semicircle is propelled back and forth by a pitman attached to it from a crank."

By turning to page 77, of the last volume, it will be seen that Mr. Charles B. Goodrich, of Rutland, Massachusetts, obtained a patent, on the 10th of May last, for a machine acting upon the principle above described. Of this machine we thought very favourably; of the originality of inventorship we know nothing.

---

89. For a *Locomotive Carriage;* William Heston, Philadelphia, Pennsylvania, October 11.

This locomotive carriage is intended to be propelled by a lever to be worked backwards and forwards by hand, which lever is to operate upon ratchet wheels placed upon one of the axles.

Much stress is laid upon this carriage being worked by *lever power;* and there is evidently an idea entertained by the patentee, that there is some great gain in thus working it. We are informed that "the principle may be applied to the working of all kinds of machinery, and particularly boats, and rail-way cars, by manual or steam power." No doubt it may, but what there is of novelty, or what advantage is to be derived from this particular mode, we are not told, and do not know.

---

90. For an *Elevating Bedstead*, for the use of invalids; David Boncroft, Grafton, Windham county, Vermont, October 12.

The upper half of the frame and sacking bottom is made to raise up to any desired angle, by means of pulleys and a rope, which are represented under two or three different modifications, differing but little from former modes of effecting the same object.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for a Self-adjusting Rail-road and Street Car, with Guide Rails adapted to the same. Granted to JOHN POLLOCK, *of Hopewell, Lower Oxford, Chester county, Pennsylvania, October* 1, 1830.

To all to whom these presents shall come, be it known, that I, John Pollock, of Hopewell, Chester county, Pennsylvania, have invented new and useful improvements in the rail-road and street car, with guide rails adapted to the same. This car I denominate the self-adjusting rail-road and street car, as it is designed to adjust itself to all the ordinary purposes of transportation, on either rail-roads, common roads, or streets, or to turn out from one rail to another, as necessity may require, which objects I effect by the guiding apparatus attached to the fore axle, or bolster of the car, and by placing at the intersection of common, or termination of rail-roads, a simple system of guide rails, which acting simultaneously on the guiding apparatus, attached as aforesaid, enables the car, on leaving the rails, to adjust itself to the common road, or street; or, on leaving the common road, or street, to adjust itself to the rail-road, or turn out, from one rail to another.

Also by a new mode of coupling, the wheels are made to track, or follow each other, in either a straight, or curvilinear direction. By the combined agency of the guiding apparatus and coupling, the use of flanches is avoided. And that the following is a full and exact description of the same, reference being had to the drawings which accompany this specification, and which make part thereof. The bed and wheels may be of the general construction in ordinary use, except that in the mode of guiding and coupling the cars, which I use, (as before observed,) the use of flanches on the common wheels is dispensed with. The peripheries of the wheels are made broad to admit of casual deviations in their motions, or accidental variations in the width of the rails. The axles on which the wheels revolve, are made of iron, and fastened under the lower bolsters which support the bed. In the centre of the hind bolster is a hole in which is a bolt, with a head, or shoulder on which the bed rests. In the centre of the fore bolster is a similar hole with another bolt, or pin, which supports the fore part of the bed. On this bolt is a large broad head, in which are two grooves, or openings, at right angles to each other. The groove parallel with the bolster is to give play, or rocking motion to the bed. The other groove which is parallel with the bed is to admit a horizontal pin which is made fast to the bed, and acts as a pivot on which it may rock, (as above alluded to,) when the wheels are passing over unequal planes. The coupling which I use, may be applied either to a single pair of axles, (as for one car,) or an indefinite number, when many cars are designed to be attached together. It is formed by two rods placed obliquely, and crossing each other in the centre. These rods are connected to the axles or bolsters, at or near the same, by a joint or pivot on which they turn freely. The rods form tangents of circles, the bolts which support the bed being the centre of the circles. The same radius is used at each end of the coupling, and should be equal to about one-fourth of the length of the axles, inside of, or between the wheels. The joints, or pivots, being placed at the intersections of the radii and tangents.

The rails on which the car is to run may be of either wood or iron, of the common construction, and modes of fixtures, except the guide rails which will be hereafter described. The self-adjusting apparatus for bearing against the sides of the rails, is constructed as follows. There are two levers, or fender rails, (equal in length to about half of the distance between the two main axles,) connected to the fore axle, or bolster, near the wheels, by two short projecting pieces forming pivots for them to work on. The other ends of them project forward, their line of direction forming an angle more or less acute with the plane of the road, on which the car is to travel. They may be connected firmly by cross bars, or braces, or in any other way by which they will have advantage to traverse the axle under the bed, thereby adapting the periphery of the fore wheels to the inclination of the rails. The outer ends of these fender rails, (or guide levers,) are fended from the rails by the interposition of wheels, for the purpose of reducing the friction. These wheels are retained in a horizontal position, as near as possible, (when elevated or depressed,) by attaching them by their axles to the lower ends of upright slings. These slings have in their upper ends an opening, or slit, to admit of their moving up and down on pins, which are attached to the ends of suspending gallows that are made fast to the axle or bolster. The lower ends of the slings are connected to the fender rails by a small axle, or rod, passing through them, on which they have liberty to work. This axle also has two small wheels on it for the purpose of reducing the friction when rolling on the inclined planes of the guide rail, thereby raising or lowering the adjusting apparatus. To secure the adjusting apparatus, either up or down, there are two dogs formed on the principles of the hammer lever; the angles, or fulcrums of which, are connected to the fender rails on one side, by a pivot, on which they work, at a distance from the outer ends of the fender rails, equal to about one-third of their whole length. One end of each hammer lever extends upwards, with a projecting knob on it, for the purpose of catching and holding against the edge of a mortise, or pin, in the suspending arm, or gallows. The other ends of these levers project forward along side of the fender rails, for the purpose of being elevated by the guide rails, or being depressed by their own gravity. The outer extremity of the whole self-adjusting apparatus, as above described, is suspended and retained in its proper position by the bed, on which is a small piece projecting downwards with a slit to receive a slider, which is made fast on the gallows, thereby allowing the lateral movement of the adjusting apparatus; or the same purpose may be effected by a similar contrivance of a slider and gallows on the opposite side of the fore axle in connexion with the bed, or coupling rods. It will be seen from the above arrangement, that any lateral effect produced on the outer extremity of the self-adjusting apparatus will cause the fore axle to traverse on its centre bolt under the bed, and from thence the motion is communicated by the coupling rods to the hind axle, causing it to move on similar lines and angles to those described by the fore axle. The guide rails, (to answer the purpose before alluded to,) are placed parallel with, and between, the common rails, on a platform which is in the same plane with the common rails. The ends of the guide rails next the intersection of common roads, or streets, are curved, and may meet. Their upper sides are parallel to the plane of the platform, or road, on which they are laid. The other ends form inclined planes on their upper sides, which inclinations extend about half of their lengths, and terminate in an elevation a little above the horizontal ends. There is also a projecting lip, or edge, extending along on the outside of the inclination in the same plane with it, as far as the highest part where the inclination of the lip or edge is reversed.

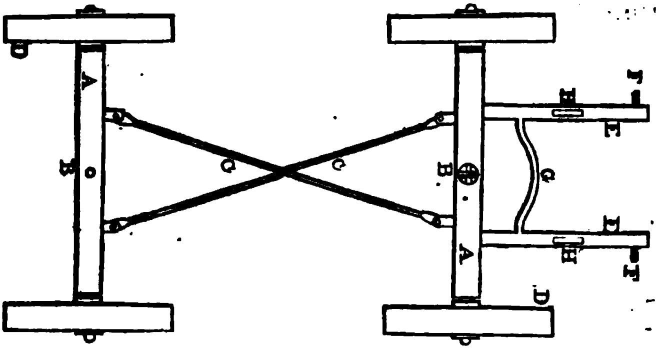
The simultaneous movements of the self-adjusting apparatus, when it is passing off from the rail-road, are accomplished in the following order. The upper ends of the dogs are released from their hold, *on the under side* of the gallows, by their lower ends ascending the projecting lip, or edge of the guide rail, at the same time the fender levers and wheels are elevated by the inclined plane to their summits, and suspended by the upper ends of the dogs catching on the upper sides of the gallows, as the lower ends descend the reversed inclination on the summit of the lip, or projecting edge of the guide rail. When the car is returning to the rail-road, the fender wheels come first in contact with the horizontal ends of the guide rails, which direct the car on to the rails again, when, by the simultaneous agency of the adjusting apparatus, the fenders are depressed to their former position, by the same causes which effected their elevation. What I claim as new, and my invention or discovery, in the foregoing discovery, is, first, the self-adjusting or guiding apparatus, attached to the fore axle of the car, by which it is made to answer the several purposes hereinbefore described. Second, the tangent coupling or connecting rods, as before described. Third, the guide rails placed at the intersections, terminations, &c. of rail-roads, to answer the purposes hereinbefore described.

I wish it to be understood that I do not claim the exclusive privilege of using guide wheels, neither of shifting them, but only their use in connexion with my self-adjusting apparatus as connected with the car. *I do* not deem guide wheels to be necessary for the hind wheels of my car; but, if required, they may be made to operate upon the same principle as those of the fore wheels.

John Pollock.

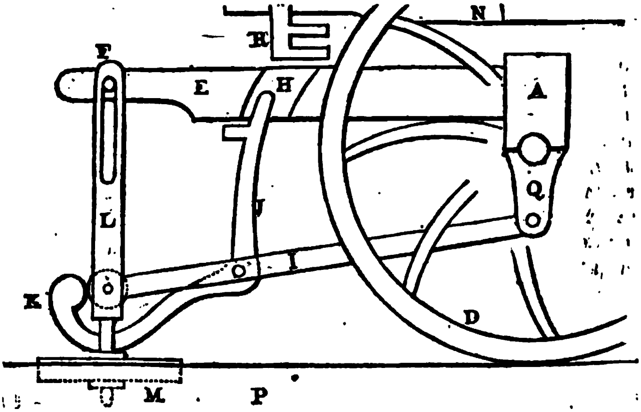
DESCRIPTION OF THE DRAWINGS.

Fig. 1, *top view of the carriage.*



A, A, the bolsters and axles. B, B, the centre bolts. C, C, the coupling rods. D, D, wheels. E, E, the gallows, or arms. F, F, pins for the slings to move on. G, the slider. H, mortise or slits in the slider.

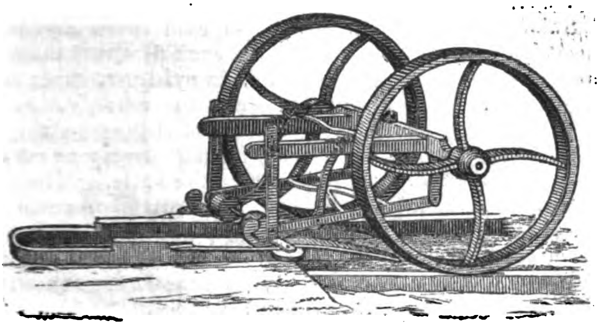
Fig. 2, *side view of part of one of the front wheels, and of the principal adjusting parts.*



The same letters refer to the same parts in both the figures.

I, fender rails. J, the upper end of the dog. K, its lower end. L, sling attached to the fender rails. M, fender wheels. N, bed sill. P, road rails. Q, projecting pieces forming pivots to the fender rails.

Fig. 3, the fore wheels of the carriage and the guide rail shown in perspective.



Remarks on the Self-adjusting Rail-road and Street Car. By the Patentee; *together with some observations upon Rail-roads.*

The advantages of the "Self-adjusting Rail-road and Street Car" will be more evident, when the many objections to the using of flanches are fully considered; which objections have arisen from experience in their application. It need scarcely be remarked that they are the only means hitherto adopted, generally, for confining the car to the rails. That they have not answered the purpose for which they were intended, as satisfactorily as is desirable, all will admit, who have any experience in their application to rail-roads. They are not only subject to a great amount of friction, by their lateral pressure, against the rails, but this pressure, which creates the friction, is, itself, an evil of no common magnitude, as its effect is to loosen and spread the rails. The cause of this effect is too obvious to need illustration, and its truth is confirmed by the frequent repairs requiring the re-securing of the rails; and the evil will increase with the curvature of the road, as the axles are necessarily placed parallel to each other. They cannot form the radii of the curve on which the car is to move. The rubbing of the flanches will also be increased by increasing the length of the car, and the distance of separation in the axles, as the farther the axles are apart, the more they will deviate from the radii of the curve. This must be an evident defect, as it will render the cars unfit for the transportation of timber, lumber, &c. which will form a great part of their use in this country. That this objection has not been so often repeated, is to be attributed to the almost exclusive use to which rail-road cars have hitherto been applied, viz. the transportation of stone coal and passengers, in which short coupling only is required.

2. As the length of the car is increased, it will be of great importance to increase the distance between the axles also, and that the distance between the wheels of a train of cars, be as nearly equal

as possible, to give them an equal bearing on the rails, and divide their weight equally on them. To accomplish the same purpose, it will be an advantage to load the cars lightly, and have the more of them in train. The rails may also be injured from another cause. The wheels being made fast on the axles, each of them must perform the same number of revolutions; now it is evident, that, on curved roads, this will not be required; and one of the wheels must *slip* and *rub*, thereby creating additional friction, and injury to the rails, as before alluded to. Again, the bed not having liberty to rock on one of the axles, is another source of injury to the rails. The axles being confined to the bed, (though they are permitted to revolve,) will cause all of the wheels to form the same plane with each other on their under edge. Now if the rails in the same part of the road are not on the same plane with each other, (and they are not easily made so at first, and still less easily kept so,) the two diagonal wheels will have to sustain all the weight of the load, consequently the wheels, axles and rails, will have to be stronger than they need otherwise be, and the rails liable to be loosed from their bearings.

3. It will be seen, by a reference to the foregoing specification, that none of these disadvantages accompany the "Self-adjusting Rail-road and Street Car." And that it is not only free from these defects, but is in possession of many valuable properties heretofore unemployed in the construction of rail-road cars. I am the more convinced of this fact, from the undivided opinion of many scientific gentlemen who have examined it at various places where I have exhibited it, and who unanimously concur in ascribing to it such advantages and peculiarities of economy as will warrant its introduction into almost any section of the country. Should any object to the means of confining the car to the rails, on the grounds that it will be insecure, I would answer that they are quite as efficient as that of the flanch. The guide wheels being confined down between the rails, have a controlling power over the other wheels, equal, if not superior, to the flanch, as they are not so liable to be raised out of their places by the lateral pressure as the flanches are, and moreover, the principal wheels being made very broad on the edge, or tread, easily assumes the curves of the rails by the adjusting apparatus having adequate advantage over them.

Any lateral effect by the line of traction, is easily overcome by having a short tongue made fast to, and projected from, the axle as far as the guide wheels, when the end of it may connect the propelling power, by means of a swivel joint, which will bring the lateral pressure directly against the side of the rails by the guide wheels. This supposed defect may be effectually obviated by making the wheels broad on the tread or edge. I should say six or eight inches would be sufficient to admit of any variations in their course, in traversing the rails. This object may also be effected, (as suggested in the specification,) by attaching the system of adjusting apparatus to both ends of the car; and thus the traversing of the axle may be limited to suit the curve of the road which has the shortest radii.

And thus it will be seen that any direct lateral effect against the car, cannot remove it without breaking some of its parts.

4. The fact of its combining the properties of a rail-road and street car, must greatly enhance its value, as articles transported on this car can be carried (off the rail-road into towns, villages, &c.) without unloading, immediately to their place of destination. Consequently, thereby saving an immense amount of labour, expense, and time. Another valuable property arising from this peculiarity of the car, is, that it will cross a common road turn-out from one line of rails to another, without difficulty or delay, and with any required facility by the self-adjusting principle, which principle will be found an important feature in this car. All that will be requisite to enable this car to cross any common road, will be a short platform of plank at the termination of the rails, and side of the common road, to support the guide rails, which are united with the common rails, at crossing places and terminations. Another important feature in the construction of the "Self-adjusting Car," is its adaptation to roads of any curvature, thereby rendering it practicable to avoid the necessity of levelling down hills, as they can be surmounted by winding the road along their sides. The distance, also, between the axles, may be increased to any length, without increasing the friction by the lateral bearing against the curved rails.

5. Another advantage, no less valuable than the foregoing, is anticipated from the introduction of this system. As the rails are not liable to injury from any lateral pressure, and as the extension of planes offers no resistance to rolling bodies, and for the same reason bodies in contact will be less indented by a given pressure, it is obvious that a wooden rail four or five inches broad, would be as little indented by the perpendicular pressure of the wheels as iron plates two inches broad and one-half thick, (which are the usual dimensions, and will cost not less than one thousand dollars per mile, for a single track or line,) and of course may be substituted for the iron. I can speak with more confidence on the comparative advantages of wooden rails, with those of iron, from numerous experiments with a car one-fourth the common size, and two sections of rails, one of wood, the other faced with iron. The car was loaded with three times the proper weight, and run back and forward many hundreds of times, without the lest perceptible difference, and an increase of weight only increased the resistance to the moving power, in the same ratio, which shows that the increase of resistance was the result of friction at the axles. Iron, however, may be used where it can be procured, but its expense would be, in many places, an insurmountable obstacle to the use of rail-roads.

6. The reduction of friction at the main axle, is a subject which many have attempted to accomplish. Secondary, or friction wheels, have been, by some, thought to answer this purpose. They may, if deemed expedient, be applied to this car, with the same effect as any other. I, however, do not recommend them, as their advantage will scarcely warrant their introduction. They have been long before the public, and their merits are fully known. Their chief re-

duction is supposed to exist in the rolling movement they give in place of the slipping one. This seeming advantage is not without its difficulty. The point of contact between the main axle and the friction wheel is so small, that they are easily indented or bruised, in which case they increase what they are designed to diminish.

7. The only resistance to be encountered on level roads, is friction, but as a horizontal plane is not to be expected in the location of rail-roads of any considerable length, another resistance will be to encounter from gravity. A power which will keep the car in motion on the plane, will be insufficient to propel it upon a slight inclination. This will be better illustrated from the following statement. The usual abatement made for friction is one pound to every two hundred of the load. The resistance of gravity will be as the length of the plane exceeds the altitude. In an inclination of 6 inches to the 100 feet, or 26.4 feet to the mile, the resistance from gravity and friction would be 2 pounds; double this inclination, and the resistance will be 3 pounds to every 200 of load, (one-fourth of the load is deducted for the weight of the car, although it is here included,) triple the first inclination will give 4 lbs. to 200. Now if we admit 112 lbs. for a horse power, he will draw on a level 10 tons, and on the first inclination cited above, he will draw 5 tons, on the second 3⅓ tons, on the third 2½ tons. From these facts it appears that only one-fourth of the resistance in the last result is from friction. This shows that large expenditures in the reduction of friction are not commendable. The ordinary wheel and axle will, in most cases, be the safest, especially if the journals be steeled, and well hardened and polished.

8. The material used in the construction of the principal wheels, should, I think, be cast iron; it is the most durable, and susceptible of the neatest conformation. Caution is necessary in the forming of the arms or spokes, to guard against the contraction which they undergo while cooling in the mould. Small castings contract more in proportion to the quantity of metal than large ones, and as the arms are less than the rim, they are subject to this inequality, as may be seen in the expansion and interstice when they are broken. To remedy this defect, I would make the arms crooked, or curved. The radius of the curve equal to that of the periphery of the rim. This allows the arms to give, or expand, to suit the rim.

9. In the construction of our rail-roads, we have taken England as a model after which to copy, without ever asking the question, whether her plans were adopted from motives of policy, or necessity. This appears to me preposterous. England, it is known, uses iron rails, but may this not be accounted for from the fact, that she has iron in greater abundance than timber. In the United States, the reverse is the fact. Here, population is dispersed over an immense extent of territory, while England is small, and her population dense. To connect the principal cities of the United States would require tenfold the extent of rail-road that it would require to connect those of England. Hence it is obvious that if we would enjoy the use of rail-roads extensively, we must adopt some plan less costly than that

of iron. Wood offers a ready substitute; timber, as fine as the world produces, abounds in our country, which may be procured so cheap, that to make a wooden rail-road would cost but little more than to make a good road for ordinary carriages. These wooden rails may be confined to the ground either by sills of timber laid at right angles, with grooves in which the rails may be imbedded and made fast by keys or bolts; or they may be supported on posts of wood sunk in the ground sufficiently deep to be undisturbed by the effects of frost. Timber which will admit of splitting into pieces of 6 or 8 inches square, will be found the best, as trees which will quarter that size, and are sound, may be considered in their prime. The juices which all kinds of timber contains, and which is a great means of its early decay, should be expelled by kiln drying. This is a cheap and easy process, and would increase the durability twofold. Farmers who have taken the precaution to season well their posts for fencing, will testify to the truth of this observation. Posts have this advantage over sills; where steam power is used, the expense of levelling may be greatly diminished, as the posts may be raised to a considerable elevation above the ground; and this elevation would also be an advantage, as it would tend to keep the rails free from the effects of gravel and frost. Where suitable stones could be procured and set in the ground endwise, with holes drilled into the upper ends by which to secure the rails, they ought to be substituted for the wooden posts.

10. These posts, whether of wood or stone, should be well set into the ground, and secured by ramming a large quantity of broken stones, or pure gravel, around them, and may be placed at intervals of 8 or 10 feet, provided the rails are 8 or 10 inches deep. The rails may be confined to a proper width apart, by small scantling extending across, and made fast to them. The width of the rails should be about 5 feet from centre to centre, or 4 feet 8 inches between them.

11. It now remains for an intelligent community to decide how far these remarks are applicable to the state of our country, and whether we shall wait until able to construct iron rail-roads, or lay hold of the means now in our power, and employ wooden rails, which will ensure, before they are worn out, sufficient capital to construct those of a more durable material. I am firmly persuaded that were we to adopt the foregoing system of car and rail-road, we should so far convince the public of their advantage in a general and commercial point of view, as to insure capital sufficient to construct rail-roads of any description. The great mass of the community are not aware of their advantages, and are not willing to risk their capital in a speculation attended with such enormous expenditures as that of establishing iron rail-roads, while they would willingly contribute to the formation of a wooden one of trifling cost.

Respectfully, yours,

JOHN POLLOCK.

Specification of a patent for an improvement in the manufacture of Reeds for Weavers. Granted to Jacob Senneff, *of the City of Philadelphia, October* 1, 1830.

To all whom it may concern, be it known, that I, Jacob Senneff, of the city of Philadelphia, have invented a new and useful improvement in the manufacturing of reeds for weavers, in which heat is applied for the purpose of straightening the splits or dents preparatory to their being set in the reed, and that the following is a full and exact description of the process, and of the machinery by which the same may be effected.

In accomplishing the end proposed, I proceed upon the well known facts, that wood, or cane, or strips of either, confined in any form, and then submitted to the action of heated water, or steam, or in any way heated, when imbued with moisture, and afterwards dried, will retain the form given to it, whether curved or straight.

I take the strips, or dents, prepared in the usual way for making reeds, and after soaking them in water, arrange them in rows, either upon boards or metallic plates, prepared to receive them, placing them flatwise together, and extending them along nearly the whole length of the board, or plate. Two or more rows may be thus extended, according to the width of the board, or plate, upon one end of which there should be a projecting cleet, or ledge, to sustain them. I cover any convenient number of boards, or plates, in this way, and place them over each other. I then place them in a frame prepared for the purpose, in which pressure may be made upon them, by means of screws, wedges, or otherwise. When thus pressed, they are submitted to the action of heat, and then perfectly dried, which, if necessary, may be quickly done, by placing the whole in an oven.

For the purpose of giving a practical view of my mode of procedure, I have accompanied this specification with a drawing of the press in the form in which I now employ it, not intending to confine myself to this particular construction, as what I claim is not the form of the press, but the process for straightening splits for reeds, upon the principles above described, that is to say:

I claim the mode of straightening splits, or dents, for weavers' reeds, by the united aid of heat, moisture, and pressure, between flat plates. Jacob Senneff.

Specification of a patent for an improvement in the preparing of Clay for Making Brick. Granted to Jared G. Talcott, *Glastonbury, Hartford county, Connecticut, October* 1, 1830.

The machine for preparing clay for making brick, is a cylindrical tub open at the top, fixed on a firm platform, with a perpendicular shaft passing through the centre, resting in a socket on a supporter beneath the platform; having a sweep attached to the head of it, for the purpose of causing it to revolve by horses, or other power.

The tub is filled about two-thirds of its depth from the bottom up, with square bars of iron, about four inches apart, passing from side to side, and secured, with the angles of the squares vertical and horizontal, intersecting each other with a small angle, and leaving room in the centre for the shaft. The main body of the shaft is an eight square timber, through every square of which are driven bars of square iron about four inches apart, and in length nearly the diameter of the tub. These are drawn out into horizontal knives, gradually commencing about one-third the distance from the shaft, to the extremity; and these knives are so disposed as to pass through in the revolutions of the shaft, every intermediate space of the horizontal bars in the tub, or cylinder.

By the means of successive revolutions of the shaft with the knives, the mixture of sand and clay, or clay alone, is perfectly prepared, when it reaches the bottom of the tub, where it passes off fit for moulding, through an aperture, into a platform, where the striker stands to perform his labour without any removal of the preparation.

The improvement claimed in the machine, is, the placing the bars and knives in such a position as to clear it from all obstructions of roots, grass, and other substances incidental to clay, without stopping its operation, merely by reversing its motion, which effectually prevents delay, and is a great saving of labour, as well as preparing the clay better with less expense than any machine hitherto used.

Jared G. Talcott.

Specification of a patent for an improvement in the art of manufacturing Malleable Iron from Pig Metal. Granted to Thomas Cotton Lewis, *Pine Creek, Allegheny county, Pennsylvania, October* 1, 1830.

I do hereby declare that, according to the best of my knowledge and belief, I am the original and sole inventor of an improvement in the manufacture of malleable iron by means of a reverberatory furnace for melting and refining the pig metal, without the aid of bellows, or the necessity of coaking the mineral coal. Hitherto, the pig metal has been refined by means of a blast run out refinery, heated by mineral coal coak, or the char of wood; and in consequence of the pig metal being laid, (stratum super stratum,) upon the coak, they melt down together, and the impurities of the coak must, more or less, incorporate with the metal while in a state of fusion. The method I have adopted, will obviate those evils, as well as be a considerable saving to the manufacturer.

A reverberatory furnace is first provided, fifteen feet long in the clear, by four feet wide; the grate, or fire-place, is three feet long, by four feet wide; the body of the furnace is nine feet long by four feet wide; the neck of the furnace leading into the stack is eighteen inches long; the bottom of the stack, or flue, is eighteen inches square, making the whole inside length fifteen feet; over the flue stands the stack, which is thirty-five feet high by eighteen inches square in the clear. On the side, or front of the furnace, and centre of the grate, stands the stock hole of nine inches square, for introducing the mineral coal into the grate. Upon the same side, or front, and the middle of the nine feet length, is a door for introducing the pig metal, which door way is twenty-two inches wide by eighteen inches high. A door of cast metal is made to shut up said door way, as soon as the metal is introduced, that as little air as possible may be introduced into the furnace. In the centre of the door, and at the lower edge, is an opening of five inches high by three inches wide, for the purpose of agitating the metal while in a state of fusion; while the metal is melting, said hole, or opening, is stopped up by a brick, or piece of cast metal, made to fit such opening. In the body of the furnace, opposite the door way, is the basin for receiving the melting metal, which is ten inches deep below the door way, or fore plate. Said basin is two and a half feet diameter at the bottom, to slope gradually from the upper part, or face of the bottom. Said bottom is made of coarse sand of the silecious kind, and the clearer such sand is of alumine, or calcareous matter, the better it will endure the heat of smelting. When the furnace is sufficiently heated for melting, ¾ to one bushel of charcoal is to be introduced into the basin through the door way; after which, one bushel of forge, or hammer cinder, previously made, which cinder is to cover the charcoal previously introduced. After which, eighteen or twenty hundred weight of pig metal is introduced, which is carefully to be laid round the basin, leaving spaces, if possible, between all the pigs, for the action of the flame to facilitate smelting. As soon as the charge of metal is introduced, fresh coals are to be thrown into the grate, the fire well stirred up, and the stock hole closed with small coal, to prevent any current of air introducing itself that way; in fact, no air ought to be let in if it can be prevented, otherwise than through the fire from below the grate. The fire being well kept up for the space of an hour, the metal will have nearly melted; as soon as the workman perceives that to be the case, it will be necessary for him to introduce an iron rabble into the furnace through the opening in the door, and draw the whole of the metal from the sides, into the basin; then introduce ¾ to 1 bushel of charcoal upon the face of the metal in fusion. The fire must be kept up as strong as possible, and the metal frequently agitated with an iron bar or rabble. In half an hour after the whole is melted down, it will be sufficiently decarbonized to let it run out through the tapping hole which is upon a level with the bottom, or ten inches below the fore plate, or door sill. Cast metal boxes are prepared, about 3½ inches deep, 20 inches wide, and 10 or 12 feet long, and placed below the tapping hole to receive the metal; in half an hour such refined metal will be ready to take out of the box, and hauled out of the way.

Much depends upon the skilfulness of the refiner, in depriving the metal of its carbon, and, at the same time, to prevent too great an oxidation from taking place. If the metal is sufficiently fluxed, the texture will be clear, and more or less branching like the fibre of an oak leaf; with from ¼ of an inch to an inch of honey comb appearance upon the upper surface.

A furnace upon the above construction, if properly attended to, will refine 3½ to 4 tons, in twelve hours, and consume 15 to 18 bushels of mineral coal to each ton, two bushels of the char of wood, and 22 cwt. of pig metal to each ton of refined metal. The advantages of refining after the above method, will appear obvious to every discerning mind, as the metal is not brought into contact while in a state of fusion, with any part of the mineral coal.

From the intense heat of the furnace, the volatile parts of the coal are consumed, or pass along the roof of the furnace into the flue, while the surface of the metal is protected by the charcoal and the scoria, which in all cases keep uppermost without incorporating with the metal. Refining after the above way will be of great advantage to forges which bloom by means of charcoal, as it will greatly facilitate the procedure and lessen the quantity of charcoal used. The iron made as above is quite malleable, close in texture, and fibrous. One great acquisition is, that said refining furnace requires no machinery attached to it, and may be erected out of the way of all other buildings. THOMAS C. LEWIS.

ENGLISH PATENTS.

To JOSEPH D'ARCY, *Esq. executor of* CHARLES BRODERIP, *for certain improvements in the construction of Steam Engines.* Dated November 29th, 1828.

THESE improvements the patentee divides into three sections:—the first consists of an arrangement of parts, added to the cylinder of the steam engine, by which the beam, side rods, parallel motion, &c. are rendered unnecessary. In this method the piston rod is attached by a moveable joint, or ball and socket, to the piston, and the upper part is connected with a crank, which conveys motion, as required, to other machinery. The piston rod, in its passage upwards, passes through a jointed stuffing box, which slides horizontally along the top of the cylinder, in reverse directions, alternately, according to the strokes of the piston; by this means the piston rod will oscillate, and produce rotary motion, without the assistance of the usual apparatus employed for that purpose.

Another method is described by Mr. D'Arcy for effecting this object, in which he does away with the sliding stuffing box. In this instance the rod is also attached to the piston by a hinged joint; but a metal chamber or trough, sufficiently large to admit of the angular oscillation of the rod encompasses it, and being attached to the piston, it works perpendicularly through an aperture correctly formed in the covering of the cylinder, and well packed to prevent the escape of steam. Of these two methods, the first described is pointed out as being the most useful.

The second section of the invention is what the specifier terms "a compound connecting frame;" but we are at a loss to discover what novel feature there can be in attaching three cranks to a straight frame of metal, which are evidently the whole of the component parts of this compound connecting frame. It is stated, that it may be adapted with advantage to an engine formed on the principle above described, which, by superseding so much of the usual gear, will be found particularly suited to land and water carriage, from its occupying much less than the usual space.

When it is desirable to place the engine very low down in a vessel, the power can be communicated to the paddles in their ordinary situation by using the connecting frame above mentioned, one of the cranks being attached to the shaft of a spur wheel communicating with the piston; the second, to a part of the vessel to serve as a guide; and the third, to the shaft of the paddle wheel.

The third section, after a lengthy description of a valve, to which no claim is laid, is described as being for the economizing of the caloric employed in the generating of steam, by causing the smoke and heated air proceeding from the furnace, to pass in a horizontal direction through a "steam receiving vessel," and subsequently through a vertical chimney. The valve before alluded to, (which, not being a part of the invention, we refrain from particularizing,) is directed to be placed in the steam pipe between the boiler and the steam receiving vessel, which latter is represented in the drawings of the specification as being a square metal box, divided by a vertical partition; and the patentee lays claim to the operation of shutting off the steam for a stipulated period, as necessity may require, from the boiler to the receiving vessel; but not as regards any other situation. [*Rep. Pat. Inven.*

To BENJAMIN GOULSON, *Surgeon, for certain improvements in the manufacture of Farina and Sugar from Vegetable productions.* Dated December 14, 1829.

THIS patent is stated to be for two distinct processes: the one, for converting certain vegetable productions into farina or flour; the other, for manufacturing the same into saccharine matter or sugar, and are described as follows:—

The roots or vegetable productions to be employed, are dahlia, carrots, turnips, beet, mangel-wurzel, and potatoes. These being well stripped of their skin, or washed, are steeped, either whole, or cut in slices, in pure water and acid, in the proportion of two pounds of acid to one hundred pounds of roots for the dahlia, and increasing the quantity of the acid for the remaining roots, in the rotation they are mentioned, up to ten pounds for potatoes. Any acid substance or acid salt will answer the purpose, but that preferred is sulphuric acid. When sufficiently acted upon by the liquor, the roots will become white and soft: the former is then to be run off, and the latter, after being well washed in pure water to deprive them of the acid, are directed to be dried in the sun, or in stoves, and then to be ground: farina, or flour, will thus be produced, which may be used in lieu of wheaten flour for making bread.

In the second process, the farina obtained by the above method, is directed to be boiled in dilute sulphuric acid, in the proportion of two pounds of acid to one hundred pounds of farina, and saccharine matter or sugar will by this means be formed, which is clarified in the usual way. The sugar can be also obtained from the roots before being manufactured into farina, by subjecting them at the temperature of the atmosphere to the action of ten pounds of acid to one hundred pounds of roots. [*Ib.*

To THOMAS COBB, *for certain improvements in the manufacture of Paper intended to be applied to the covering of Walls or the hanging of Rooms, and in the Apparatus for effecting the same.* Dated September 15, 1829.

THIS patent embraces several objects relative to the manufacture of paper for hanging rooms.

The first described is a method of manufacturing tinted paper by *embossing during* the process of making, which is effected by *passing the pulp* between rollers or plates, one of which, at least, is engraved with any suitable device: the colour is mixed with the pulp previously to its being rolled, and the paper is consequently but of one hue.

The second process is for embossing the paper after it has been made, in which plates and rollers, as in the former instance, are also employed, but with this difference, that one or more of them are directed to be heated, by which it will be made to resemble silks and other substances.

The third is for uniting two pieces of paper together, by means of an apparatus that shall presently be described, for the purpose of giving it a more solid appearance, and also for increasing its durability when pasted against the walls. The sheets or lengths of paper may be either of the same colour, or the one white and the other coloured. The upper or outside sheet may be embossed by either of the means described, or the two may be embossed, after their being joined together, as may be found most convenient.

The fourth part of the invention is for uniting paper with pieces of silk, cotton, or other suitable substance, by which, it is stated, that an appearance of much greater than their actual value will be imparted to the latter. The silks or other substances are coated on one side with any glutinous matter, and being placed in their proper situations on the paper, the whole is passed through the rollers as in the former instance. It is recommended to cause the paper to be twilled, by passing it previously through rollers with grooves formed round their circumference, by which means, it is stated, that the paper will more readily receive the stamp of the embossing roller, and consequently give a sharper appearance to the silk.

The fifth and last object of the patent, is, for the machine before noticed for pasting together the sheets or lengths of paper. In this machine, the white paper to form the under side being wound round a roller properly weighted, to prevent its unrolling too quickly, passes upwards through two rollers covered with plush, one of which may be also converted into a rotary brush; this latter revolves in a box of paste, and coming in contact with the paper, covers it evenly with a coating of the paste. The paper then proceeds upwards till it arrives at a large drum or winding roller, where it meets the other paper on which it is to be pasted, and which is conveyed from the opposite side of the machine by means of guiding rollers; the whole being properly weighted, it is kept distended, and presses evenly with the pasted paper on the drum, on which it is wound to any length required.

In the final clause of the specification, the patentee declares, that he does not claim as his invention, the embossing of paper in general, but only as regards that employed for the hanging of rooms; he also states, that he does not confine himself to the mode described of pasting together sheets of paper, but that the same may be effected by any known method. [*Ib.*

To JAMES STEWART, *Piano Forte Maker, for his having invented certain improvements on Piano Fortes, and in the mode of stringing the same.* Enrolled, September, 1827.

THERE are three features of improvement proposed under this patent; the two first, consist in certain novelties in the construction and adoption of the dampers of double action grand piano fortes; the last is in the manner of attaching the strings to their pins, on all descriptions of piano fortes.

In the first place it is proposed, instead of bringing the damper wire immediately over the string which is to be acted upon, to place it two semitones, or one whole note off. As for instance, if the string to be acted upon is F, then place the wire damper between the string of G and G sharp, and so of the damper wires of all the other strings. The wires of these dampers are to be placed further back in the instrument than usual, in order to leave room for the introduction of a stopper, to prevent the recoil of the hammer after the note has been struck.

The second improvement is taking off the weight of the dampers, to render the touch of the instrument delicate, which is effected by partially raising the damper lever, and only allowing a part of it to bear upon the key.

Third, it is proposed, instead of forming a loop at the end of the string, for the purpose of attaching it to the hitch pin, to fix a very strong hitch pin, and to pass the string round it, bringing the end of the string back again to another tightening pin, and so causing one string to form two unison cords. It is stated that the friction of the string, on the hitch pin, will be sufficient to hold it, and to allow of the string on each side, constituting two cords to be tuned separately. [*London Journal.*

To Joseph Jones, *Gentleman, for his invention of an improvement in certain parts of the process of Smelting, or obtaining Metallic Copper, from Copper Ore.* Enrolled, January, 1824.

This improvement is designed to assist the fusion of the metal contained in copper ore, and comes into operation after the ore has been brought into that state called regulus, or coarse metal.

Regulus, the patentee considers, contains sulphuret of copper, with sulphuret of iron, and in order to cause the copper to run more readily, he proposes to mix the regulus with a portion of copper ore that is free from sulphur; which, if not pure in its natural state, must be rendered so by calcination. The pure metal acts as a flux to the copper ore, and the iron then flows on the top, which may be taken off by skimming, or drawn away at the tap hole.

The quantity of copper ore required, will depend upon the state of the regulus, which will be readily found, and this process being repeated several times, will considerably expedite the operation of smelting. [*Ib.*

To William Grisenthwaite, *Esq. for a new process of making Sulphate of Magnesia, commonly called Epsom Salts.* Enrolled, February, 1829.

This new process by which Epsom salts are to be produced, is by mixing together magnesia, sulphate of lime, or plaster of Paris, with carbonic acid and water, which will form a sulphate of magnesia.

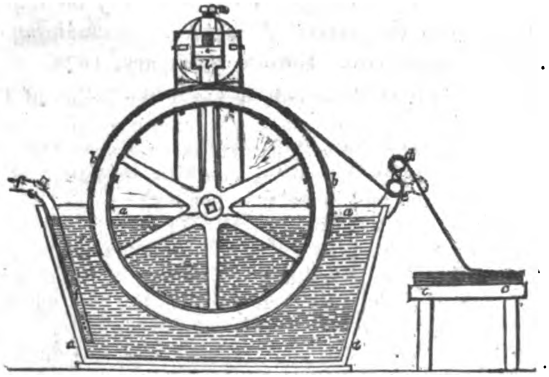
The magnesia is to be obtained either by precipitation from sea water, or by the common earthy precipitations, or from the magnesian lime stone. The same modes of evaporation and crystallization, are to be employed, as are usually practiced by chemists.

The patentee claims to be the first who has used sulphate of lime, and carbonic acid, for the production of the above salt. [*Ib.*

To Henry Hirst, *Clothier, for his having invented certain improvements in manufacturing Woollen Cloth.* Enrolled, Aug. 1830.

My improvements in manufacturing woollen cloths apply to that part of the process of finishing cloth, where a permanent lustre is given to the face of the cloths, usually by a process called roll boiling, that is, stewing the cloth when tightly wound upon a roller in a vessel of hot water or steam.

As there are many disadvantages attendant upon the operation of roll boiling, such as injuring the cloths by overheating them, which weakens the fibre of the wool, and also changes some colours. I propose to substitute in place of it, a particular mode of acting upon the cloths, by occasional or intermitted immersion in hot water, and also in cold water, which operations may be performed either with or without pressure upon the cloth, as circumstances may require.



The apparatus which I propose to employ for carrying on my improved process, is shown in the accompanying drawing, which is a section taken transversely through the middle of the machine; *a, a, a,* is a vessel or tank, made of iron or wood, or any other suitable material; I prefer it to be sloping at the back and front, and perpendicular at the ends. This tank must be sufficiently large to admit half the diameter of the cylinder or drum, *b, b,* to be immersed in it, which drum I propose to make about four feet diameter, and about six feet long, or something more than the width of the piece of cloth intended to be operated upon. This cylinder or drum, *b, b,* I construct by combining segments of wood cut radially on their edges, which I secure by screw bolts to the rims of the iron wheels, having arms with an axle passing through the middle.

The cylinder or drum being thus formed, and rendered smooth, on its periphery, and mounted upon its axle in the tank, I now wind the piece of cloth upon it as tightly as possible, which I do by placing the cloth in a heap upon a stool, as at *c, c;* and having passed its end over and between the tension rollers, *d, e,* as shown, and then secured it to the drum, I draw the cloth progressively from the heap, between the tension rollers, which are confined by a pall and ratchet, or otherwise, on to the periphery of the drum, by causing the drum to revolve upon its axis, until the whole piece of cloth is tightly wound upon the drum; when I bind it round with canvass, or other wrappers, to keep it secure.

If the tank has not been previously charged with clean and pure water, I now fill it nearly to the brim, as shown in the drawing, and then opening the stop cock of the pipe, *f,* which leads from a boiler, I allow steam to blow through the pipe, and discharge itself at the lower end, by which means I raise the temperature of the water in the tank, to about 170 deg. (Fahrenheit.)

Before the temperature of the water has got up, I put the drum in slow rotary motion, in order that the cloth may be uniformly heated throughout, that is, I cause the drum to turn, at the rate of about one rotation per minute, and in this manner I continue operating upon the cloth by immersing it in the hot water, and then passing it through the cold air in succession, for the space of about eight hours, which gives the cloth a smooth soft face, the texture not being rendered harsh, or otherwise injured, as is frequently the case by roll boiling.

After operating upon the cloth in the way described, by passing it through hot water, for the space of time required, the hot water is to be withdrawn by a cock at the bottom, or otherwise, and cold water introduced into the tank in its stead: in which cold water, the cloth is to be continued turning in the manner above described, for the space of twenty-four hours, which will perfectly fix the lustre that the face of the cloth has acquired, by its immersion in the hot water, and leave the pile or nap to the touch, in a soft silky state.

In the cold water operation, I sometimes employ a heavy pressing roller, *l*, which being mounted in slots in the frame or standard, revolves with the large drum, rolling over the back of the cloth as it goes round. This roller may be made to act upon the cloth, with any required pressure, by depressing the screws, *m*, *m*, or by the employment of weighted levers, if that should be thought necessary.

[*Ib.*

To E. W. RUDDER *and* R. MARTINEAU, *Cock-founders, for certain improvements in Cocks for draining of Liquids. August 20th,* 1830.

THE plan proposed to be adopted by these patentees, is, to manufacture liquor cocks out of sheet brass, or other suitable material, by stamping a piece of brass of an appropriate size, by a powerful press and suitable dies, into the form required to constitute the exterior casing, and by a similar process to form the interior of the cock. These pieces are then to be soldered together, with the seam of the one piece on the side opposite to the seam of the other.

The plug is also formed of two pieces of sheet brass stamped into form and soldered together, and also to a top piece which is cast solid. The hollow cavities above and below the liquid way through the plug, are to be filled up with solder or lead, according to the purpose for which the cock is intended.

It is to be regretted that the patentees have not pointed out, in their specification, the advantages of this new method of manufacturing cocks, for the benefits seem far from being obvious, and we fear but few will be able to discover them.

[*Register of Arts.*

To C. RANDOM, BARON DE BERENGER, *for improvements in Fire-arms, and in certain other weapons of defence. August*, 1830.

THE improvements in fire-arms here contemplated, are of two kinds: first, the lock is rendered more secure against accidental discharges; and, secondly, the percussion powder, or priming and charge, are better protected from wet by rain, or accidental immersion in water. The security against accidental discharges is obtained by interposing between the hammer and the touch-hole, a piece of metal to receive the blow in case of the tricker being moved. This guard, which turns back on an arm, can only be removed by drawing back a sliding plate placed under the stock, immediately before the tricker guard; and this sliding plate is drawn back by the left hand when pressing the fowling-piece against the shoulder, in the act of firing, so that no discharge can take place unless the piece is pressed against the shoulder at the same instant that the tricker is drawn. Another modification of this protecting apparatus is described to consist of a pin in connexion with the sliding plate, situated as before, passing into the tricker, and preventing it from moving till the sliding piece is drawn back, as in the other case; and, to render both these plans still more secure, the sliding plate is fixed by a small screw, which can only be released by a key similar to a watch key. This may be useful, occasionally, when a loaded gun is put aside.

To protect the percussion powder, priming, charge, &c. from the injury of rain, the patentee proposes to have the lock entirely within the stock, and an opening, which serves to introduce the percussion caps, has a cover which fits air tight upon it. The touch-hole in this case proceeds in a sloping direction through the breech to the middle of the concave surface of the front of the breech. A vent hole is opened by the act of firing, which allows the escape of the smoke arising from the firing of the priming.

Baron de Berenger's improvements in other defensive weapons, consist in a method of better securing bayonets on the muzzles of muskets, than that generally adopted, and a method of regulating the weight of a sword to the strength of the man using it. When bayonets are made to fit tightly on the muzzle of muskets, they are difficult to fix and unfix, and when they are made to fit loosely, they are likely to be accidentally unfixed when in use, or a horseman can sometimes dexterously unfix them with his sabre. To remedy these defects, the Baron proposes to make the bayonet pass over a projecting sight on the musket, in the usual way; but, instead of the notch for the projection turning twice at right angles, he only turns it once, passing it on by a longitudinal slit of the whole length intended, and then turning it in a transverse slit about a quarter of a revolution. Now, to prevent the bayonet from being turned round and accidentally detached, the ramrod passes into a projecting eye in the bayonet. In order to effect this, the ramrod is to be withdrawn about half an inch, when an opening in the side of the eye passes over the rod; and when it is again returned, a thicker part of the rod fits into the eye, and prevents the bayonet from being turned till the rod is again withdrawn half an inch. This is really a very simple and secure method of locking the bayonet to the musket.

The other improvement, which applies to the bread or cutting kind of swords, and not to the small or stabbing sword, consists simply of a piece of metal secured upon the back of the sword by screws, and this can be removed at pleasure, nearer to, or farther from, the point to regulate the weight, and, consequently, the momentum of the sword to correspond with the strength of the man using it; for, as his strength varies by exercise, or otherwise, he can vary the momentum of his weapon. [*Ib.*

To SIMON THOMPSON, *Mariner's Compass Maker, for certain improvements in Piano Fortes. August* 26, 1830.

THE improvements contemplated by this patentee apply to the kind of instruments which have been distinguished by the appellation of cabinet piano fortes, and the object is to obviate the necessity for any part of the casing rising above the locking board, so that the top of the instrument is made flat like a table, and there is no silk front before the performer to deaden the voice in case of accompaniment. This object is effected by lowering the string frame till its upper surface coincides with the top of the locking board, and making the keys-bent levers turning twice at right angles between the fulcrum on which they move, and the extremities which act upon the hammers. On the inner ends of each key, rests an upright guide, wire or slight rod, and to this are attached various projecting pieces which actuate the hammers, the dampers, &c. much in the usual manner, so that this improvement, which is a very important one, is obtained without in the smallest degree altering the other parts of the instrument. [*Ib.*

To P. C. DE LA GARDE, *for certain improvements in apparatus for Fidding and Unfidding Masts, and in Masting and Rigging Vessels. August* 27, 1830.

THE old method of fixing and unfixing top and top-gallant masts, is attended with considerable inconvenience and insecurity, and hence have been proposed at different times various plans for facilitating the operation. For several of these, patents have been obtained; we do not, however, recollect any of the plans which are more likely to come into general use than the one before us, as all the operations connected with it are such as seamen are in the constant habit of performing. The fid, which supports the upper mast, consists of two wedges or keys passing from opposite sides over the trestle-trees through a slit in the mast. The wedges are placed with the thick end of the one over the thin end of the other, that the seat on which the mast rests may be horizontal; and they are drawn into their places by tackles hooked to their smaller ends, at the same time they are sent home by the blows of a mallet applied to their thick ends. When the wedges are brought home, they are secured in their places by locking pieces connecting their ends. The operation of unfidding is performed by changing the tackles from the hooks in the small ends, to those in the large ends of the wedges, and drawing them back, the locking pieces being at the same time disengaged. All these operations are greatly facilitated by a series of anti-friction rollers placed between, as well as above and below, these wedge shaped pieces constituting the fid.

The patentee next describes his method of masting to consist of a kind of iron frame of a rectangular form, with diagonal stays fixed with iron straps to each side of the lower mast near its top. To these iron frames the shrouds are to be hooked instead of being attached to the mast in the usual way, by means of fastenings, which project on every side, and which, therefore, keep the upper mast so far from the lower as to render the fidding both clumsy and insecure.

An improvement in fastening the main sheet and other sails is next described. This consists in placing an iron rod to extend from the fore part angularly across the vessel, to the starboard or larboard side, according as the vessel is upon the starboard or larboard tack. Upon this rod is placed a traversing pulley, which is used for tightening the sail, and the advantage of this arrangement, is, that the pulley can be brought opposite the sail, or rather the end of the yard, in whatever direction it may be placed. [*Ib.*

To John Surman, *Lieutenant and Riding-master, in the Tenth Hussars, for improvements in Bits for Horses, and other animals. August* 28, 1830.

The improvements contemplated by this patentee, are of two kinds—the first, having reference to the form of the bit; and the second, to its connexion with the frame of the bridle, or rein levers. With respect to the first, it would appear that the lieutenant has not yet ascertained which is the best form to be adopted, for he describes several. One plan is to introduce a circular bend in its middle, (thus —⌒—); another, with an elliptical opening in its middle, (thus —○—); a third, with the middle spread out into three branches; and a fourth, with it spread out into four. These are described without any instructions as to the circumstances under which any one, or all of them are to be applied. The first form is certainly not new, and the third and fourth are far from being good, as they will cause a constant pressure on the tongue of the animal to which they may be applied. The improvement in the attachment of the bits consists in permitting the bit, of whichever form, to rotate in the side frames with which it is connected; and this rotation is obtained either by making the bits hollow, and passing a fixed axis through them, or else converting their ends into pivots to turn in the frames, with collars either screwed or rivetted on their ends, to prevent their slipping out. The rein levers, which are made hollow to a certain extent, are connected to the bridle frame by means of spiral springs, that they may, on the application of force, deviate a little from the rectangular position, and rest upon a projecting circular shoulder. [*Ib.*

FRANKLIN INSTITUTE.

Quarterly Meeting.

The twenty-eighth quarterly, or seventh annual meeting of the Institute, was held at their Hall, on Thursday, January 22, 1831.

James Ronaldson, president, in the chair.

Mr. Samuel J. Robbins, was appointed recording secretary, pro tem.

The minutes of the last quarterly meeting, and also of the meeting held this day, at 3 o'clock, to appoint the tellers, and to open the poll of the election of officers and managers of the Institute, for the ensuing year, were read and approved.

The annual report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on publications, with instructions to publish such parts as they may deem expedient.

The annual report of the Treasurer was read and approved.

The tellers appointed to receive the votes of the members for the officers and managers, made their report, when the president declared the following gentlemen duly elected officers and managers for the ensuing year.

James Ronaldson, *President.*
Isaiah Lukens, } *Vice Presidents.*
Thomas Fletcher, }
James H. Bulkley, *Recording Secretary.*
Isaac Hays, M. D. *Corresponding Secretary.*
Frederick Fraley, *Treasurer.*

Managers.

Samuel V. Merrick,
Abraham Miller,
William H. Keating,
Adam Ramage,
Isaac B. Garrigues,
Rufus Tyler,
John Struthers,
John O'Neill,
M. W. Baldwin,
Joseph H. Schreiner,
Samuel J. Robbins,
Mordecai D. Lewis,
Charles H. White,
Thomas Scattergood,
Thomas Loud,
Benjamin Reeves,
Thomas U. Walter,
Alexander D. Bache,
Alexander Ferguson,
Joshua G. Harker,
John Agnew,
Charles Toppan,
Mark Richards,
John Wiegand.

Adjourned.

James Ronaldson, *President.*

S. J. Robbins, *Recording Secretary, pro tem.*

Seventh Annual Report of the Board of Managers of the Franklin Institute.

To the Franklin Institute of the state of Pennsylvania, for the Promotion of the Mechanic Arts, the Board of Managers respectfully present their seventh annual report.

THE return of our anniversary meeting calls upon the Board to present to the Institute a general view of the condition of the institution, of the objects which have been accomplished or promoted during the past year, and of those which will require the active exertions of the new Board.

It is pleasing to add that our efforts have met with a due share of success.

Education was the first object of the Institute, as they considered it the corner stone of the edifice which they wished to raise to the promotion of the mechanic arts. With this view it attracted their earliest attention, as well as the uninterrupted solicitude of each succeeding Board; and as far as we have been concerned, it is hoped that every opportunity has been improved to consolidate the excellent system originally adopted. The lectures on chemistry and natural philosophy, with its applications to mechanics, have been productive of that additional degree of usefulness which was to be expected from the increased experience of able professors. These lectures are to be considered as the ground work of instruction in an institution of the nature of ours. Motives of prudence imperatively required, in the origin of the society, that our plans should be limited, in order to be successful; but it is a question which presents itself, in our more mature condition, whether further extension may not be given to our system of education, without endangering its permanency or its usefulness. It is probable that such might advantageously be attempted, and it is a subject to which we would earnestly invite the attention of our successors. Much good has undoubtedly been done; but this reflection, however gratifying, would be productive of little advantage, if it were not followed up by the inquiry, how far this good may be extended? It is not difficult to point out the branches which require attention; the only embarrassment is in the selection of those of most urgency. In this enumeration of *desiderata* in general education, we propose to avoid every thing like a competition with other institutions. Our city is not yet sufficiently populous to require, or perhaps even to justify, a competition on many branches of science, but there are some which naturally belong to our institution, and in which the public confidently expect us to take a lead. Foremost among these we would suggest the subject of machinery, or practical mechanics, as contradistinguished from the theory of mechanics, usually taught in lectures on natural philosophy. Experience clearly shows that the subject is too vast to be embraced in one course; and while it is evident that the rudiments of the science of mechanics are indispensable, it is equally clear that a practical acquaintance with the details of the construction of machines, is an object not less to be desired. Nor is it to be believed that this point can be satisfactorily obtained by neglecting the other branches of natural philosophy, to concentrate our attention exclusively upon mechanics: for who that was not acquainted with the properties of heat, or with the laws of pneumatics, could pretend to understand the operation of the steam engine, or even of the common pump? &c. and to take an instance from one of the noblest and most recent applications of science to the useful arts, who can pretend to judge of, or justly to appreciate a locomotive engine, that has not first mastered the leading principles of natural philosophy, and then made himself familiar with the construction of machinery? It appears to us that this subject is one which the Institute is now able to undertake, and we would earnestly recommend it to the early attention of our successors. Again, at a moment when the greatest interest has been manifested by this city in the promotion of mining, when much capital is embarked in the search after favourable deposits of mineral wealth, or in the extraction of it from the earth, is it not a subject of regret that there should not be at this moment, in this city, a public course of lectures on mineralogy, and that the able and enterprising individuals, who have manifested an anxiety to lecture on geology, should have met with no cheering on the part of the community to which they were willing to devote their gratuitous services? Such lectures, we are aware, cannot be duly encouraged, unless brought before the public under the patronage of institutions resting upon an independent foundation; but it is from these that men of science have a right to expect assistance; it is to these that our liberal and patriotic citizens look to direct them in their anxiety for the promotion of all that can contribute to the welfare of our community. Other branches, perhaps equally important, naturally present themselves; but enough has been said to show that the great field which the Institute had appropriated to itself, has as yet been but very partially cultivated.

Next to our lectures, and closely connected with them, are our public schools; upon this subject the Board have nothing to add to the reports of their predecessors. The same solicitude for their prosperity was felt and displayed. The same gratifying popularity attended the drawing school; the same failure was again experienced in the attempt to enlist the attention of the public in favour of the mathematical school. Again baffled in their wishes, if not in their hopes of success in the latter, the present Board deem it their duty to state that their opinion of its usefulness remains unimpaired; and while they believe that the present plan has been sufficiently persevered in to justify a conclusion that, on its present foundation, it is not likely to receive adequate encouragement from the community, they would earnestly invite the attention of their successors to this object, that they may consider whether some more popular plan may not be devised, or whether the project is to be abandoned as wholly hopeless. The high school, of which the Institute may proudly boast as an offspring of theirs, continues to flourish and to be useful.

The Board have much pleasure in stating that the experiments upon water wheels, which were projected and prepared in 1829, have, during the last year, been continued with unremitting zeal and attention by a committee of the Institute. The experiments are now completed; the report is in preparation; and, as it may be expected to be published shortly, the Board will not anticipate at present the information which it is intended to embrace. They will, however, state their conviction, that the results will be found highly interesting to science and the arts, whether in confirming certain theories hitherto resting upon doubtful observations, or in correcting the errors resulting from imperfect and unsatisfactory experiments. The majority of the Board feel themselves perfectly justified in expressing their opinion on this subject, without the fear of rendering themselves obnoxious to the charge of arrogance, as they deem it a duty to add, that the whole credit of it is due to the committee of the Institute to which the investigation was entrusted.

Another important inquiry was commenced and prosecuted by the Institute, during the present year. Its object is to examine into the causes of the frequent explosions of steam boat boilers, and into the remedies which may be proposed to obviate them. This inquiry, which has been continued for several months, has led to the accumulation of much information, collected from various sources, and which the committee, to whom the investigation was entrusted, hope to be able soon to embody into a preliminary report. It was at first believed that, however valuable a series of experiments on this subject would prove to be, it was not in the power of the Institute to undertake it at this time; as it would involve an expenditure too great for the limited funds of our association, and which we did not feel ourselves at liberty to expect from the friends of the Institute, who had so recently, and so liberally, contributed to the experiments upon water wheels. It has, however, occurred in this case, as in all the preceding ones in which the Institute has found itself in pecuniary difficulty, that assistance would never be denied to disinterested and judicious efforts to promote the public good; a fund was placed at the disposal of the committee, which will enable them to extend their inquiries much further than had been originally contemplated. The apparatus for the experiments is now nearly prepared, and it is hoped that they will be soon commenced. If any thing could have added to the pleasure which the Board experienced at the receipt of this fund, it was the knowledge that the efforts of the Institute to promote the success of the mechanic arts, had met with the general approbation of our fellow citizens, as is manifest from the high source by which this proof of unsolicited liberality has been extended to them.

Another of the objects which may be considered as having received the particular attention of the Board, is, the extension of the facilities of the reading room and library. These had hitherto been postponed, from the impossibility of furnishing sufficient accommodations for them. By a fortunate concurrence of circumstances, the officers of the United States' courts were induced to propose that heir lease should be cancelled, under certain conditions, which were deemed sufficiently advantageous to the Institute, to justify us in the acceptance of them. The rents from our building have, it is true, been partially reduced by this circumstance, but we consider the loss as fully compensated by the increased accommodations we enjoy. The Institute have now the use of the two lower stories of their building, with the exception of the front offices. A new spirit has been infused into the society. A handsome contribution of books, minerals, and money, was immediately raised among the members, and the reading room was opened, under its new organization, on the 23d of September last. The library now consists of upwards of 500 volumes, and is receiving daily accessions. In it are already to be found many valuable works on the mechanic arts; and it is the firm belief of the Board, that with a little attention on the part of our successors, it may soon acquire a value in this department of bibliography which no library in this city, and perhaps none in the country, now presents. In examining into the character of our libraries, it will be seen that among the many public ones in Philadelphia, (not less than 20 or 30 in number,) there is none that possesses any especial value as a technological one. While the city and Loganian libraries, by their extent, and by the rarity and value of their contents, are just subjects of pride to our citizens; while those of the American Philosophical Society and of the Academy of *Natural Sciences* contain vast treasures in science; while the libraries of the hospital and law society are rich in the departments which they were intended to promote; there is not in Philadelphia a single institution, in which the formation of a collection of books relating to the applications of science to the arts has been deemed worthy of special attention. In a city like ours, this is undoubtedly a great desideratum, and nowhere is it so proper that such a collection should be formed, as within the walls of this institution. With this object, we would beg to suggest that every means be taken to cultivate this department; though not to the exclusion of others, yet giving it a decided preference. It has been asked whether we intended to exclude donations of books not connected with science or the arts? Our answer is evident. By no means. It is desirable to create a taste for books among the members, and particularly the younger ones; who, from the want of opportunity, have been hitherto, perhaps, precluded from extensive reading. This taste we all know is gradually acquired. It must be cherished by giving them works that shall not fatigue their attention, and by affording them that variety which refreshes the mind and stimulates the intellectual as well as the physical appetite. But every opportunity should, we think, be taken to exchange duplicate works, or such as may be deemed irrelevant to the purposes of the Institute for valuable works on the arts, whenever such can be obtained. In doing so, it is believed that we in no manner interfere with the intentions of the donors, who may in all cases be safely presumed to have desired to manifest, by their liberality, their interest in the welfare of the Institution. In effecting exchanges of books, the Board have, hitherto, adopted the rule of carrying those obtained in exchange, to the credit of the donors of such as were parted with. This plan, it is believed, must satisfy all, that the Institute have no other object than to increase the value of the present. Still the Institute would gladly accept of donations that may be made under a condition that such books shall not be exchanged; and in such cases the conditions imposed by the donors shall be religiously adhered to.

Although the reading room has been opened but a few months, yet its benefits have already been felt; connected with the monthly meetings for scientific discussions, it is seen to increase the interest of the members in the institution: and as the benefits are more extensively shared, they will add to the desire on the part of our fellow citizens, to enlist themselves among the members of the Institute.

This will produce its effect upon our cabinets of models and minerals. The former, though yet very limited, exhibits some very interesting specimens of the ingenuity of our artists.

We must not omit to advert to the exhibition of domestic manufactures held under the auspices of the Institute, in September last; a prouder display of the evidences of American ingenuity and enterprise has, we believe, never been made either in this or in any other city; but on this point we deem it unnecessary to enlarge, as a detailed account of it has already been for some time before the public. It is a point on which this Board has not yet come to a decision, whether the exhibitions had better be repeated annually, or only biennially. Should the new Board determine to hold one next fall, no time must be lost in preparing for it; a plan is under consideration which will, it is believed, contribute much to enhance the brilliancy and usefulness of these interesting exhibitions.

The Board advert also with pleasure to the condition of the Journal, because it is believed to have materially improved in the last year. If not productive in a pecuniary point of view, it at least tends to enhance the character and extend the reputation of our association. It assumes every year a more popular form, and appears to excite more interest in the community at large. This the Board believe to be in a measure due to the excellent plan of publishing the list of patents, with remarks upon all of them. The occasional introduction of the specifications at large is also of primary interest; and we have only to lament that the restricted condition of our subscription list precludes the insertion of a greater number of such as require plates for their elucidation. Hitherto the state of our funds has been such as to prevent our appropriating an adequate compensation to the Editor. Were the Journal such as to allow us to secure the exclusive services of our present Editor, or to associate some other person with him, and to afford a stated remuneration to all contributors, such as is practised with other literary and scientific Journals, there is no doubt that the value of our publication would be greatly enhanced. For this we must throw ourselves upon the enlightened liberality of the public. It behooves every member of the Institute to be zealous in procuring additional subscribers to the Journal.

We have cause to regret also, that more active measures have not been taken to increase the list of members of the Institute. Our numbers appear to have continued stationary, while the demands upon our funds have greatly increased since the origin of the society. This arises from the great extension given to its sphere of usefulness. It is estimated that the number of annual contributors does not much exceed 600; while there can be no doubt that a society of the nature of ours *ought*, in such a city as Philadelphia, to command at least 2000. When we look to the extent of our system of education—to the *liberality* with which it is made to include all the younger individuals of a member's family—to the privileges of the library and reading room, which in other institutions cost more than twice as much as the whole amount of our annual contribution—to the advantages which members have in visiting the exhibitions—and when we recollect that all this is obtained by the small annual payment of three dollars, free from all other charges, we have reason indeed to be surprised that our list of members should not have swelled to a much greater number than that above stated. At the close of their services, the Board deem it their duty to urge it upon the members of the Institute, both collectively and individually, to exert themselves to procure new contributors. If each of them were to make it a point to obtain at least one new member, (a matter of little difficulty,) the benefits which would accrue to all would be inconceivably great, as we should then triumph over the principal impediment *that has hitherto* retarded our progress.

The Treasurer's report hereto annexed, exhibits a balance of $918 73 in his hands, from which, however, must be deducted, the amount of orders drawn, $296 66, which will reduce that at the disposal of the next Board, to $622 07.

The following gentlemen have, within the last year, become life members, viz.

Henry Seybert,
G. M. Elkinton,
John Struthers,
John C. Lowber,
Francis Kearny,
Alexander Ferguson,
Joseph Warner,
Charles Wetherill,
William Schively,
I. S. Barnard,
I. P. Morris,
S. R. Simmons.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, December 23, 1830.

Mr. Thomas Fletcher, vice president, presiding.

Mr. George W. Phipps, recording secretary pro tem.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Messrs. Carey and Lea.

The Chemistry of the Arts, being a Practical Display of the Arts and Manufactures which depend on Chemical Principles, on the basis of Gray's Operative Chemist.

Arnott's Elements of Physics, Vol. 2nd, Part 1st.

By M. Carey, Esq.

Rapin's History of England, 15 *Vols.*

Twenty Pamphlets on various subjects.

By Mr. Isaac P. Morris.

Ferguson's Lectures on various subjects.

Experimental Researches concerning the Philosophy of Permanent Colours, by Edward Bancroft, No. 3.

Phillips' Elementary Introduction to the Knowledge of Mineralogy, by Professor Samuel L. Mitchell.

A Manual of Mineralogy, by Arthur Aikin.

The Eloquence of the British Senate, by William Hazlitt.

An Appeal from the Judgments of Great Britain respecting the United States, by Robert Walsh, Jr.

Roman Antiquities, or an Account of the Manners and Customs of the Romans, by Alexander Adams, LL. D.

By Mr. S. C. Atkinson.

The Casket, for 1830.

By Mr. George W. Phipps.

A Dictionary of Arts and Sciences, 4 *Vols.*

By Isaac Hays, M. D.

Ecole Centrale.

Biographical Sketch of Alexander Wilson.

Documents from the Navy Department, the Post Master General, and the Commissioners of the General Land Office, accompanying the President's Message to Congress.

By Mr. Thomas Harper.

An Address of the Managers of the Schuylkill Navigation Company.

By Mr. James Ronaldson.

A Review of Mr. Cambreling's Report from the Committee of Commerce.

By the Hon. William Marks, Senator.

Documents accompanying the President's Message.

By M. St. C. Clark, Esq. Secretary of the house of representatives of the United States, by resolution of the house.

Journal of the House of Representatives, from the 1*st to the* 13*th Congress, inclusive,* 9 *Vols.*

The Diplomatic Correspondencies of the American Revolution, edited by Jared Sparks, 8 *Vols.*

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute, viz.

The American Quarterly Review, for December.

The Magazine of Useful and Entertaining Knowledge, for November and December.

The Illinois Monthly Magazine, for December.

The Mechanics' Magazine, and Journal of Public Internal Improvements, for November.

Annales des Mines, Vol. 7, Parts 1 and 2.

Annales de l'Industrie et Bulletin de l'Ecole Centrale des Art et Manufactures.

Annales de Chimie et de Physique, for July.

Journal Universel des Sciences Médicales, for June.

Recueil Industriel, for August.

Bibliothèque Physico-economique, for September and October.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, for July.

A communication from Col. J. L. Sullivan, on the subject of Winans' Friction Rail-way Carriage, was read, and after being discussed, it was, on motion, referred to the committees on publication and on inventions.

The discussion of explosion of boilers of steam engines being called up as the order of the evening, Professor Alexander D. Bache read a letter received by him, giving a further account of the explosion on board the steam boat Caledonia, together with remarks on the subject by the writer.

Other communications on the same subject, were received and discussed, after which they were referred to the committee on explosions, and the subject continued to the next meeting.

THOMAS FLETCHER, *Vice President.*

GEORGE W. PHIPPS, *Recording Secretary, pro tem.*

TO THE FRANKLIN INSTITUTE.

Remarks on WINANS' *Rail-way Carriage.* *By* JOHN L. SULLIVAN, Civil Engineer.

SIR,—When I submitted to the Institute, in April, 1829, a description of the rail-way wagon, invented by Mr. Winans, depositing a model at your Hall, and soliciting a committee on this invention, I expected, of course, that its imperfections, as well as merits, would not escape their discernment. I considered the Franklin Institute as a tribunal of science, to which every inventor might bring the product of his ingenuity, and offer its *usefulness* to a fair and skilful investigation, in the hope, if not in the confidence, that a favourable opinion of it, by men competent to judge, might introduce it to the public under the *best* auspices; or, its defects being pointed out, be previously remedied. I was not, therefore, disappointed in the result of the report.

My attention had been drawn to this improvement as an instrument in the *public economy* of rail-roads. Experiments with models had given me quite as much confidence as its mechanical combinations warranted; and taking some small interest in its success, I felt that it was not only proper, but extremely desirable, that my own favourable judgment should be sustained, by the good opinion of perfectly disinterested parties.

When, therefore, the committee pointed out certain supposed liabilities to *peculiar* stress, and *unequal* wear, and in expressing the "wish to see a carriage on this construction of full size in operation," suspending their full approbation until this opportunity of mature judgment should arise, I perceived it would be incumbent on me, for the interest of the inventor, as well as for my own credit as a mechanician, to make a further communication when practice should have tested the value of the machine, and due progress have been made towards its perfection; availing myself of the hints conveyed, with equal politeness and good will, in the report.

To do this, however, it was necessary to wait the slow progress of events; and now, though apparently tardy, I hope and presume a brief account of this invention, up to this time, will be acceptable to the Institute, not only as that of a new machine, but of an instrument concerned in the prosperity, possibly, of Pennsylvania, in the extensive rail-roads she is forming as part of the great line of commercial communication between her capital and the navigable waters of the west. The nature of all mechanical improvements very much depend upon the magnitude of the purpose to which they are applicable, and there are few greater than the cheap transportation of the materials of the internal commerce, together with the agricultural and mineral resources of this state.

In the combinations of mechanical principles, compound leverage in mills, for example, is well known; but I think it had not been usefully applied to carriages until that of Mr. Winans appeared, and with singular novelty and neatness in the mode of his subduing friction in wagon wheels.

It did not escape the notice of the committee, that the *occasional obliquity* of the main axle to the transverse line of bearing under the rim of the friction wheel, would cause the surfaces of it, and the rolling gudgeon of the main axle, to receive at such moments near the *end* of the latter, and the *edge* of the former, the whole weight due to that wheel; and they apprehend, therefore, that *these parts* would wear *most:* but did they not accidentally omit to state that the *ordinary* pressure and wear is *between* these points, and, therefore, if those parts wore down most at such times, still the surfaces must, *on the whole*, wear *equally?* so it seems to me.

Another inconvenience apprehended to be of consequence, was the *endwise* pressure of the axle against the friction wheel, making it operate with its axle as a bent lever to twist the side pieces of the frame out of place. But did not the committee lose sight of the fact, that on rail-roads there can be no considerable "swaying" of the load from side to side? that the moment there exist inequalities sufficient to produce this effect, there can be no *velocity?* that the road must be so out of order, or imperfectly made, as to fail of its purpose? that the two rails of the track must coincide in level? Indeed, so little precaution is required to be taken, that even on the temporary imperfect tracks at the Baltimore excavations, while other causes of injurious wear existed, this effect was not among them.

The accidental *injurious wear* above referred to, both explains the reason of another liability, to which the committee pointed, and in some measure supplies its *disproof.* They supposed the surface of the *rim* would, by the rolling at the gudgeon, not only wear away, but form into grooves, in one of which the rolling gudgeon of the main axle would at length make a permanent lodgment, and reduce the friction wheel to the condition of a common bearing box: it was not, however, adverted to, that before the rolling forward of the gudgeon in the rim could stop, the friction at *its axle* must be a greater resistance than that produced at its rim. The almost impossibility of thus stopping, was shown in the instance of those first large wagons, put in operation; the friction wheels of these were, (in the absence of Mr. Winans,) cast of *soft* iron, in order to be more easily turned smooth and cylindrical; but they were *so soft*, that their surface crushed under the harder surface of the gudgeon, and wore away; but wore away *equally*: for their very roughness gave the gudgeon a stronger hold, and they would have continued to revolve till worn thin enough to break.

To remedy the defect of the *soft castings*, and this liability to wear as apprehended by the committee, Mr. Winans has now succeeded in casting the friction wheels, not only in very *hard* iron, but the interior of the rim perfectly cylindrical, thus attaining *economy*, *hardness* and *smoothness*. It is found that *chill castings*, in which steel gudgeons roll or rub, work as smoothly and durably as brass. The whole carriage *now* scarcely costs more than the common kind.

The rail-road being well built, the stress on the friction wheel rim must be perpendicular to its axle, (and liabilities to surge, if they exist, may be checked at the frame,) a further improvement on them has now been made. This is to enclose the friction wheel in an iron case, which at once sustains the ends of its axle, keeps off the dust, and serves as the depository of the oil. The case is circular, and is let into the *under* side of the timber, (now single,) far enough to bring the top of the inner surface of the friction wheel *level* with that of the timber. Arms here project from it, by which it is bolted on. In England, where iron is cheap, these arms prolonged and connected, form the sides of the frame. The inner side of the case has an aperture for the main axle gudgeon to enter and lodge under the rim of the friction wheel, and with room for some play. The friction wheel is cast so as to revolve *on* its axle, and not *with* it. The nave bearing, (five inches through,) is cast to a chill pin, which being removed, receives a *cast steel axle*, fixed firmly in its place by means of screw nuts at its ends. The oil being lodged in the case, the joints of which are tight, is taken up by the revolving rim of the friction wheel, and continually carried to its axle, and to the gudgeon of the main axle. All the surfaces that move upon each other are within these four cases, thus thoroughly oiled, yet without waste. Indeed, the same mode of oiling is now applied to the first method, with revolving axles. Both methods are approved at Baltimore. This manner of oiling, as well as the slowness of the movement at the rubbing axle, is very favourable to their use with the speed of locomotive engines.

Feeling assured that the candour of the committee will allow me to meet all their objections by such new facts as have arisen, as they can have no other aim than to guard and to serve the community, I ask leave briefly to notice the remaining one or two.

They thought that the rim of the friction wheel might not be *strong enough* for the stress outwards, from the centre, so as safely to hang the weight of the load by them, there being four on the ends of the main axles, but that it would sustain the load better, if these rounded ends of the main axles were lodged on the *convex surface* of the friction wheel, then seeming to have the properties of the arch.

But may I not remind the committee that the purpose of the inventor was to avoid all *incidental*, and reduce by leverage the resistance of the *inevitable* friction? He tried the other, and thought the carriage thus more simple; and it is not really material whether the rim be one inch, or one and a quarter thick. *Not one has yet broken with even four tons load.* Besides, there is a peculiar advantage resulting from this lodgment, as I shall have occasion presently to show, in turning the curves of a rail-road.

In operation, the committee thought, too, that as the retarding force of gravity would be just as much against this wagon as against others, that it would, on the whole, be *more;* because the weight of the friction wheels would be superadded. I had, indeed, omitted to mention in my description, that the weight of the main wheels might be *at least* as much lessened, by a small diminution of their size, or otherwise, as lighter main wheels than usual will wear well with the friction apparatus. It is thus exemplified.

In practice at Baltimore, the four friction wheels with cases, weigh 100 lb. The large wheels, 700 lb. Their two axles, 236 lb. The average weight of several complete wagons, 1558 lb. One of the most complete Liverpool wagons tried in competition against one built there by Mr. Winans, both having three feet wheels, weighed 22 cwt. His 21 cwt. Besides, the objection of gravity would not apply, unless that of the friction wheels retarded the carriage more than their leverage helped it.

The committee justly observed that "nothing but actual experiment on a large scale, will fully develope the precise amount of the advantage of a machine of this nature, because it is not possible to foresee all the circumstances which will attend its construction and *use.*" This is true of its use, because its performance does not depend alone upon itself, but also on the smoothness and solidity of the road upon which it is to run. For this reason it would be doing the invention injustice to decide on its ultimate excellence by its performance under the unpropitious concomitants of a new and rough rail-road. Indeed it can hardly be expected that our rail-roads will soon be as perfect as they are made in England, where iron is cheap. A comparison of one wagon or engine with another, to be conclusive, ought to be made on the same road.

At Liverpool, the wagon of Mr. Winans was tried, as before mentioned, against one of the wagons of the rail-road company, each loaded to weigh with the carriage 80½ cwt. under the supervision of Mr. Charles B. Vignoles, one of the most eminent engineers in England. His report thereof was published in the Mechanics' Magazine, in February last. He states in that, and in a letter since printed, that he found the friction of the wagon of Mr. Winans, 2⅛ lb. to a ton, and of Mr. Stephenson's, 9¾ lb. to a ton: both with 3 feet wheels.

It is well known that the usual friction of the common rail-way carriages is 11¾ lb. a ton, and Mr. Stephenson was mainly indebted for the difference, to a part of the improvement of Mr. Winans, *the outside bearing*, for the outside projection of the axle permitted of *more reduction* of size, than the necessary strength of the axle *between* the wheels will allow of. This was Mr. Winans' first improvement.

But perhaps there can be no better method of comparing the friction of rail-way wagons, than by the elevation of the inclined plane down which they will respectively run by the force of gravitation. In the published report of the survey and location of the Baltimore road, this was, as on other occasions, considered by the engineers to be for the common carriage a little more than 30 feet in a mile. But Mr. Vignoles states that he found the friction wheeled wagon would descend by the force of gravity alone, an inclined part of the rail-road of only 5 feet 10¾ inches in a mile.

A superiority of 5 to 1 in principle thus conclusively demonstrated in full size, comes very near the original performance of the model. The best kind of wagon may be diminished in useful effect by newness, roughness, curves and ascents in rail-roads; but its superiority in principle over other carriages will still be maintained, though the power should fail to effect as much as it could, were the road smooth, hard, and level.

It is manifest, therefore, that the superiority of that with friction wheels will be great on descending ground, as well as on *level* ground. And especially so in this country, where the location of our greatest rail-roads are likely to be up and down the vallies of our rivers, for it is well known that 4-5ths of the tonnage is outwards.

It is certainly interesting to the public to see this principle in the rail-way wagon, carried in practice as far as it will bear.

Opportunities are likely to occur on the rail-roads between our great cities, which will be remarkably level. It is demonstrable, perhaps, that it is better to make considerable circuits rather than to cross high ridges. *That number of feet elevation* in a *mile*, whereon gravity alone will give motion, has been considered equal to a mile in the expense of power. But though the rail-road from Philadelphia to Columbia rises in some places 27 feet in a mile, it will be, notwithstanding, an advantageous run for locomotive engines, and this wagon will enable them to do much more service than they otherwise could. Because wherever the descent is above 6 feet to a mile, the loaded wagons will accompany the engine with all the speed it could alone attain.

It was a gratifying testimonial in its favour, at Liverpool, that Mr. Ericsson insisted on having these wagons for *his loading*, when proving the efficiency of his locomotive, the celebrated *Novelty*. And he took them rough from the quarries and excavations as they were: for the rail-road company, after the *test*, had agreed for a dozen or two of them. It was thus that the *Novelty* carried 28 tons at the rate of 8 miles an hour, as stated and published by Mr. Vignoles. And I have understood that this convinced the engineer of the company of their superiority; so too the circumstance of their use on the works under his care is a strong fact.

Indeed the weight of the testimonial given by Mr. Vignoles, is fully equal to that of *any other engineer*, and certainly is very conclusive. His investigations were made with a wagon of full size, in the presence of many witnesses. His report is of careful and repeated trials, and the result is given to the world on the responsibility of his high professional character. It amounts to a recommendation of this improvement to all the rail-road companies in England.

It would be here a fair inquiry on the part of the committee, why the Liverpool company does not employ this kind of wagon wholly. The true answer is, that they had formed an establishment, before this improvement appeared there, to build the common kind, considerably improved in workmanship and proportions, under their skilful chief engineer, who therefore reluctantly yielded to the conviction that compound leverage had a good effect in carriages. And could Mr. Winans have accepted the company's offer to remain, more of the friction wheeled wagons would have been already in use.

It remains to give an account of the progress of this invention in our own country. If not so decisive, it will not be without some satisfaction; and useful and correct information is now wanted by the public on this subject. The Baltimore rail-road, it is generally known, commences on the present borders of the city, 66 feet above tide, and is carried level 7 miles, through and over hills and vallies: and then ascends the rocky valley of the Petapsco, necessarily following the indentations of the hill, along the slope of which it is led by a winding line, the alternate curves of which are often on a radius, (it is said,) of no more, if so much, as 400 feet. In England the radius of rail-road curves is always much greater than this, having probably a better choice of ground. Their roads are nearly straight, and the wheels may be without objection wedged upon the axles.

This location, therefore, appears to have been thought to demand a kind of compromise in determining the size of the wagon wheels. The model, you may recollect, permits the main wheels to turn on the axles, occasionally a little, though in operation actually fixed by the pressure of load, and the comparatively less resistance to turning, at the axles of the secondary wheels. It *was* expected that on turning curves, this would be a convenient property, because there could be no sliding; but the difference in the length of the rails of the curve, be made up by just so much turning of the outer wheels on the main axles; it might be only a few inches.

But on a large scale Mr. Winans found, while in England, that he gained something upon *the resistance* by wedging the wheels fast: and on straight roads there was no objection to it. It then became of less consequence on *which side of the rail the flanch worked;* and he found that by putting them on the inside, as usual there, it permitted of a slight degree of cone in the rim, which by means of the faculty of adjustment in the axle to resistances, was favourable to steadiness in the progress of the carriage.

This probably suggested the idea of an increase of the cone near the flanch to favour the passage of the wagon around those *short curves*: because, on entering them with speed, the wagon would have centrifugal force enough to incline it most to the outer rail; when the effective diameter of the wheel, being increased by running on the cone, while the other wheels run on the lesser diameter of the flat of the rim, measured by equal revolutions the unequal lines of rail; and on taking the reversed curve, with the like effect; their present engineer, Mr. Knight, having calculated the exact degree of conical swell to produce these effects, on the curves of *this road.* On reaching a straight course, or the change of the curve, the vibratory or adjusting action of the main axles takes effect, and establishes the line of steadiness, when otherwise there would be *sliding*, and consequent wear of both the rail-way and the wheels.

The various considerations which entered into the subject, it appears, fixed the diameter of the main wheels at 30 inches. The friction wheels, inside measure, are 9 inches diameter.

The present unfinished state of the first section of the road, does not yet permit of ascertaining the full benefit of the principle, there being but one track; because the heavy loaded wagons are compelled to travel in accommodation to the passenger carriages, a part of the distance ten miles an hour, and five miles ascending 13 feet in a mile. At present, therefore, they do not attempt to carry more than eight tons to a horse. The passage carriages run with about 30 passengers to one horse, at 10 miles an hour, changing at half way.

But I intend, with your leave, to furnish for the Journal the further progress of practice, that the Institute and the public may have knowledge of the facts in this branch of rail-road economy, without the least reserve, wishing that only to be preferred which deserves preference.

Although the extent to which compound leverage might be carried, in rail-way wagons, is not at present determined by experience at Baltimore, still in another respect may be deduced from it, the very satisfactory result, that these carriages will run a long distance without any repairs. One of those for passengers was lately shown me at the rail-road, that had the last year and the present run loaded six thousand miles without requiring any expense upon it, and was said to be still in perfect order. And you may have seen in the Baltimore American, of the 6th inst., that one of those for heavy loads, which had run 1800 miles, was taken apart for examination, and its rubbing and rolling surfaces found in perfect order.

I do not, however, insist, from all that has been adduced, that the committee and Institute ought to feel perfectly satisfied that this improvement is of great consequence in rail-road economy. But will express the hope, that the day may not be remote, when they may see them here of *business dimensions*, and the principle carried as far as may then be found expedient.

Nor do I believe this a vain wish. There are in this state several routes where rail-roads might be beneficial to the public, and well recompense proprietors. None are more obvious than from Harrisburg to Carlisle, and from the head of Schuylkill navigation to Sunbury, (spoken of in the papers of the day,) and from Philadelphia to Trenton, should one be made across New Jersey.

With acknowledgments to the committee for their attention to this subject, and to the Institute for the indulgence of so large a proportion of their time,

I remain, very respectfully,
your humble servant,
JOHN L. SULLIVAN,
Civil Engineer.

Philadelphia, December 17, 1830.

Postscript.—Since writing the preceding additional explanation, I have seen the article on Internal Improvement, in the American Quarterly Review, for December, on which, page 293, the subject of rail-roads is a topic, and wherein mention is made of this invention. "Winans, a citizen of New Jersey, has *proposed* a carriage with a new species of friction wheels; and Fleming, a European engineer domesticated among us, has contrived a means of substituting a motion of mere rolling for that of wheels. Both have succeeded completely in model, and in experiments upon the small scale, but practical men entertain doubts, which do not appear to be ill founded, whether either can be actually applied in practice."

This passage, (I have no doubt the Editor himself will admit,) is objectionable, not only in coupling the two inventions, so essentially different, but in speaking *now* of that of Mr. Winans as it might have been spoken of *nearly two years ago*. He passes entirely over its establishment under patent, in use in England, and the account of it not only in an English publication, nearly a year ago, republished at Boston, and repeated in your Journal, in which it is certified by an eminent engineer in that country to have the mechanical advantage of nearly 4 to 1 over the best rail-way wagon before known and used, but also the *obvious practice* on the Baltimore road. The truth is, that the road itself has so absorbed admiration, that probably the Editor, or the writer of that article, may have himself rode on it without knowing that he was also on a friction wheeled wagon.

Now, with all due deference, I cannot see any use in the display of learning on such subjects, when facts so obvious and so pertinent to the very occasion, are not only passed over, *but a groundless prejudice disseminated*, as much at variance with the great interest of internal improvement, as with that of the inventor. For that article, after arguing *pro and con* the question between canals and railroads, comes to the conclusion that, "still upon the success of some *friction saving apparatus*, must depend the great question whether rail-roads can compete with canals."

Now, certainly it would have been reasonable, if known, to have adduced in support of this side of the question, *the fact* that such apparatus had actually been put in practice in our own country to an *important extent*, and carried hence acceptably even to England.

Perhaps the committee's report may have had some influence on the writer, and the cautious opinions of scientific and practical men, may have led him to do injustice, not only to the inventor, but to his subject, so immensely interesting to this country. It is not the value of the wagon to the inventor, that is of any comparative moment, but the *value of the machine to the public.* Besides that, if it has such effects in the economy of rail-roads, it must agreeably influence their location, on the very principles explained in the Review, and that will, therefore, greatly extend their benefits, not only where canals cannot be made, but where they already exist, as *tributaries* to their business, branching into districts otherwise incapable of cheap communication with the great navigable line.

The committee, it seems to me, are now invited by a sentiment of patriotism, to look further into the subject referred to their judgment. And I hope they will, in the spring, even make an excursion to Baltimore, and see the wagons of Mr. Winans in operation, and compare their performance with a simple wagon, and then make a supplement to their report, of whatever appears to them to be the practical advantage thus far attained.

Practical Observations on the Pneumatic Process for Expelling Molasses and Sirop from Sugar.

(Concluded from page 409.)

Incidental remarks on the manufacture of Sugar from the Cane Juice into Raw Sugar, and the subsequent products therefrom by refining.

In the manufacture of raw sugar from the cane juice, an expeditious and economical mode of effecting a complete separation of the heterogeneous matter in union with the saccharine, and of producing the greatest weight of crystals of the best quality, is the desideratum of the planter. But does he obtain these advantages by any of the processes now in use in the colonies? Certainly not. Improvements have been introduced in the colonies to a very limited extent, in comparison with those which have, of late years, been adopted in the refining of sugar in Great Britain. It is natural to suppose, that the first and chief aim of science would be to produce a good raw material; that such will eventually be the case, there can be little doubt; as, at this moment, a great excitement is produced in the minds of the planters, by the attempted introduction into the colonies, of various schemes and processes for improving their sugar. This has been particularly the case by Mr. Innes introducing this identical pneumatic process, which aims, not only at the discharge of the *real molasses*, or uncrystallizable matter, but also at the separation of the other impurities still adhering to raw sugar, an operation of refining which, has hitherto been effected by the refiners of sugar in Great Britain.

If this last mentioned separation is deemed of so much importance in the refining of sugar; and if, as it is admitted, greater and finer products are obtained, when the separation is effected before clarification and evaporation, with the least possible action of heat, surely similar advantages are desirable in the manufacture and crystallization of the cane juice.

Reasoning by analogy, the writer has been induced to believe, that many of the evils complained of by the growers of sugars, especially those of inferior qualities, might be obviated, not merely by an improved method of evaporation and curing, but by arrangements prior thereto. And if the writer's hypothesis upon this point should prove correct, and should be coupled with the recent improvements in evaporation, very superior raw sugars, to those now sent from the colonies, might be made, with less expense and very little increase of attention.

The hypothesis submitted is—

1st. That the sugar cane has its component parts divided, in a greater or less proportion, according to the place or distance from its root or stole.

2nd. That the earthy and denser particles, (and probably the chief portion of the impurities,) blended or united with the saccharine, are nearest to the root; and, in consequence, the saccharine juice is in a purer state progressively, from the root to the top of the cane.

If these positions are correct, would it not be adviseable to cut the lower joints from the cane before it is taken to the mill, to separate the finer portions from the grosser ones, and separately to grind and manufacture their juices? The clarification and evaporation to the consistence required for granulation, would, in the ordinary way of operating, be facilitated, and yield products proportionably better. We know, that the finest fruit is plucked from the extreme bough of a tree; and that that which is nearest to the root is more crude, although equally exposed to the influence of the sun's rays. Separation and selection of qualities is found to be essential in the making of wine, cider, and other vegetable productions; why then may not the same mode of practice apply to the cane juice? If it is found beneficial to separate the part of the cane next to the top, because the matter therein is less ripe than the other parts, surely, by a parallel reasoning, the bottom may contain other matter equally, or perhaps more injurious to the subsequent operations on the juice for the products obtained therefrom.

Under all circumstances, whether the foregoing surmises be correct or not, it must be admitted, that separation of the adventitious substances, intimately mixed and combined with the cane juice, is the first point to be obtained; and secondly, that such separation is best effected with the least possible action of heat, which, in proportion to its intensity and duration, carbonizes and coats the crystals of sugar.

The subsequent separation of this coating from the crystal is, at present, best effected by the pneumatic process; the utility of which in the colonies, for this purpose, would decrease as the improvements in growth, clarification, and evaporation, increased; and, eventually, the pneumatic process might only be necessary to accelerate and complete the curing or drainage of the real molasses, or uncrystallizable part of the cane juice. Such drainage only, whether effected by this process or by any other, ought to be permitted by the legislature, for reasons before advanced.

In treating upon the refining of raw sugar, it is intended to select those systems which, by practice and analogy, bear upon the subjects under review, instead of attempting to discuss all the varieties existing, and almost daily starting into birth.

Every refiner, either from habit, prejudice, or economy of capital, adopts that system which he thinks best and most suitable to his trade. The opinions and modes of working are almost as numerous as the refineries worked: in some, clarification by blood, with or without a previous separation of the molasses, or colouring matter, is adopted, and evaporation effected by fire pans. Some use charcoal in the clarification, others chemical compounds; some clay the goods, others use magma, or sirop, in lieu thereof; some clarify and evaporate by steam heat, instead of fire, but the most opulent of the refiners have adopted the improvements made by the late honourable Edward Charles Howard, and their products possess a more brilliant appearance, and must rank as superior to those obtained by any of the former methods, with the exception of Mr. Kneller's,* which yields equally brilliant products.

The desiderata of the refiner and planter may be classed as follows:—

1st. The best separation of adventitious substances.

2nd. The separation, clarification, and evaporation, at a degree of heat not affecting the sugar.

3d. The greatest weight of crystals of good colour and brilliant appearance.

4th. The least quantity of molasses or treacle.

5th. The shortest period of manufacturing the products.

6th. The most economical mode of working.

The two first points may be considered as axioms in the art of manufacturing sugar; and, if adhered to, will effectuate the remaining objects; and their practice ought to be adopted, primarily in the colonies, where they would be of greater value than in this country.

Incidental remarks have been made as to the adoption, in the colonies, of a mode of separating impurities combined with cane juice, previously to its being submitted to the action of heat; and the pneumatic process has been descanted upon to prove, that its use would effect the separation of those impurities which still adhere to the sugar after it has been manufactured. The planter is interested in both operations, and especially so in consequence of the immense loss by drainage, and the permission which government, at present grant, to import sugar divested of a part of the impurities and the colouring matter, at the duty payable upon raw sugar, which has not undergone the process of separation; but the refiner's interest is more immediately confined to the working of raw sugar. Such as it now is, necessity compels him to make the separation therefrom of the impurities and the colouring matter, and this he best accomplishes by a low degree of heat applied throughout his manipulations.

---

* See page 163, of our last volume.

Experience has demonstrated to the scientific refiner, that the admixture of the colouring matter *adhering* to the crystals of raw sugar, is disadvantageous to the refined products, and must be detached therefrom by the process of claying or siroping. The abstraction of the colouring substance, as a primary procedure, has been effected, both by mechanical and chemical processes, none of which have, as yet, been found equally efficacious with the pneumatic process; but with all its advantages, and like the other methods of pressing, claying, or melting, a portion of the finer part of each crystal is dissolved and mixed with the discharged or expelled colouring matter; and, however judicious the operations may be, to separate the crystallizable parts from this colouring matter, by subsequent and repeated operations, still some portion of the crystals remain in the molasses, or treacle, and are therein deposited by natural causes.

In any way, therefore, abstraction of the impurities and colouring matter, previous to clarification and evaporation, must be a positive benefit; because, by the subsequent application of heat, at the temperature required for those purposes, there is an increased tendency to carbonization in proportion to the increased degree of heat applied, its duration and repetition, which likewise operates in an increasing ratio, according to the decrease in quality of the sugar or sirop submitted to its action. The purity of the medium, or solution of sugar, also contributes materially to the abundance and beauty of the crystals.

These positions are exemplified by refining lumps into double loaves: the lumps are refined sugar, and contain a very inconsiderable portion of colouring matter; but it is necessary to separate that small portion, in order to obtain double loaves. Too much heat is applied to melt, clarify, and evaporate, in this second process; the crystals produced are very fine and white, but the residue is treacle; it must, therefore, be evident, that a high temperature, wherever applied to sugar, produces treacle, which invariably is combined with colouring matter; but still the medium in which the fine crystals are formed, is more pure than a solution of sugar not previously refined; thus heat engenders carbon.

In a previous part of this work, statements have been made as to the relative value of raw, pneumatic, and ordinary lump sugars, when used for refining: the advantages of separating the molasses or colouring substance from raw sugar, previously to refining it into loaves and lumps; and also the disadvantageous action of heat upon saccharine solutions, varying according to the degree of heat applied, its duration and repetition, and the quantity of colouring substance contained in them. It may be asked, can such statements and reasonings be substantiated by practice? Investigation is, therefore, necessary to ascertain whether such statements and reasonings are founded upon facts. It will be readily admitted, by those gentlemen who are conversant with the principles of refining, that such is the case; but to those who have not a knowledge of the art, it may be needful to prove more clearly, that the positions advanced are correct, by stating—

1st. That

112 lbs. of raw sugar, as imported, yield, by the old system of refining, by the use of a fire-pan, at a mean proof of 240° of Fahrenheit's thermometer,

28 lbs. of treacle.

2ndly. That

112 lbs. of raw sugar, in the same state, yield, by the improved system, by the use of vacuum-pan, at the proof of 155°, (afterwards raised, in the granulating vessel, to 180°,)

20 lbs. of treacle.

3dly. That

112 lbs. of raw sugar, (first partially cleared of the molasses by being made into meltings, and evaporated in the precise manner last mentioned,) yield

14 lbs. of treacle.

4thly. That

112 lbs. of raw sugar, operated upon or refined by the pneumatic process, to produce white crystals, of the quality of ordinary lumps, and the extracted sirops therefrom, evaporated at 245° of heat, will yield only

12½ lbs. of treacle or sirop.

By these comparisons it appears, that by the first method, about 28 lbs. of treacle are produced, when the molasses and colouring substance in union with the sugar, are operated upon by 240° of heat.

2nd method, when in the same state, and at 180°,

20 lbs. of treacle.

3d method, a partial separation of the molasses, &c. having been effected by meltings, and the same heat of 180° applied,

14 lbs. of treacle.

And, by the fourth method, evaporating the extracted sirop and the colouring matter in a more concentrated state, even at 245° of heat, only

12½ lbs. of treacle or sirop.

Thus showing that the degree of heat, and the repetition thereof, engenders an additional quantity of molasses, &c. to that which the raw sugar contained when imported; and that a lesser quantity is engendered when a separation of the molasses, &c. has been effected previously to the action of heat; it may, therefore, be presumed, that raw sugar contains even less than 12½ lbs. per cwt. of treacle, the *least* quantity obtained, at the highest degree of heat employed for one evaporation.

As such, the planter and refiners could not fail to obtain considerable advantages, if they adopted a better mode of evaporating the cane juice and solutions of sugar to that which is now generally employed.

Charcoal is injurious, because it destroys or weakens the crystallizing properties of sugar to a certain extent; it must, therefore, like lime, be classed as a disadvantageous agent in refining.

The French refiners use from ten to fifteen pounds of animal charcoal to each 100 pounds of sugar; their products possess colour, but are deficient in strength. Some compensation is obtained, by their evaporating to a lower proof than is usual in this country, in open fire-pans, and upon a less quantity for each skipping.

In conclusion, as to the best method of obtaining and applying heat to all purposes connected with the manufacture or refining of sugar, and with due deference to the opinions of those persons who have had a longer and more extensive experience than the writer, he submits that steam heat is to be preferred, and that simplicity in the combinations of the apparatus for that purpose is most desirable, and particularly so for the colonies.

Of all the varied schemes which have been presented to the refiners as improvements for evaporation, that of the late honourable Edward Charles Howard is the most celebrated: by his domed, or vacuum pan, as it is termed, solutions of sugar are evaporated to a proper consistence or proof, at about eighty degrees of heat below that which can be obtained in the open pans now in general use. In the domed pan a vacuum is not formed, but the evaporation of the aqueous particles is accelerated by condensation, in the absence of the atmosphere. After the discharge of the skipping, it is necessary to raise the temperature for granulation to about 185 degrees, which is effected by steam, under the receiving or granulating vessel.

The whole of Mr. Howard's arrangements are highly scientific; but his evaporating apparatus, although it has been much improved, and is less expensive than formerly, yet wants simplicity to render it generally useful, particularly in the colonies.

Many other plans have been devised as substitutes for this scientific and valuable improvement in evaporation; but none accomplishes the object so completely as that of Mr. William Godfrey Kneller, for which a patent has been recently granted.*

By this method solutions of sugar or sirops can be evaporated to proof in an open pan, by steam or other heat, at temperatures varying from 140 to 170 degrees of Fahrenheit's thermometer, consequently at from sixty to ninety degrees below the proof hitherto obtained in an open pan, and about the degree of heat required for granulation.

The apparatus attached is of trivial value, and the auxiliary employed so highly beneficial to the strength or crystallization of the sugar, that such a combination of advantages seems to be best suited to the purposes intended, but it remains to be proved, whether the refiners of this country, and the planters, will adopt this other pneumatic system.

---

* See page 163, of our last volume.

On the means of giving a fine edge to Razors, Lancets, and other cutting instruments. *By* THOMAS ANDREW KNIGHT, Esq. F. R. S. President of the Horticultural Society, &c.

IN the preparation of steel, and in the art of subsequently forming it into cutting instruments, the British manufacturers are, I believe, unrivalled; and they have probably approximated, if they have not attained, to perfection: but in the art of giving the finest possible edge to their instruments, when formed, I think they have generally still something to learn; for I hear surgeons often complain that they rarely find themselves in possession of a well set instrument; and I have never yet, in any instance, seen a razor come from a cutler so set that I could use it with any degree of comfort; though I have obtained razors from many of the most eminent manufacturers of the metropolis. The machinery which they employ, has long appeared to me to be imperfect, and uncertain in its mode of operating, and in many respects inferior to that which I have been some years in the habit of using, and which I shall proceed to describe.

This consists of a cylindrical bar of cast steel, three inches long without its handle, and about one-third of an inch in diameter. It is rendered as smooth as it can readily be made with sand, or, more properly, glass paper, applied longitudinally, and it is then made perfectly hard. Before it is used, it must be well cleaned, but not brightly polished, and its surface must be smeared over with a mixture of oil, and the charcoal of wheat straw, which necessarily contains much siliceous earth in a very finely divided state. I have sometimes used the charcoal of the leaves of the *elymus arenarius*, and other marsh grasses; and some of these may probably afford a more active and (for some purposes,) a better material; but upon this point I do not feel myself prepared to speak with decision. In setting a razor, it is my practice to bring its edge, (which must not have been previously rounded by the operation of a strop,) into contact with the surface of the bar, at a greater or less, but always at very acute angle, by raising the back of the razor more or less, proportionate to the strength which I want to give to the edge; and I move the razor in a succession of small circles, from heel to point, and back again, without any more pressure than the weight of the blade gives, till my object is attained. If the razors have been properly ground and prepared, a very fine edge will be given in a few seconds; and it may be renewed again, during a very long period, wholly by the same means. I have had the same razor, by way of experiment, in constant use during more than two years and a half, and no visible portion of its metal has, within that period, been worn away, though the edge has remained as fine as I conceive possible; and I have never, at any one time, spent a quarter of a minute in setting it. The excessive smoothness of the edge of razors thus set led me to fear that it would be indolent, comparatively with the serrated edge given by the strop; but this has not in any degree occurred, and, therefore, I conceive it to be of a kind admirably adapted for surgical purposes, particularly as any requisite degree of strength may be given with great precision. Before using a razor after it has been set, I simply clean it on the palm of my hand, and warm it by dipping it into warm water; but I think the instrument recommended operates best when the temperature of the blade has been previously raised by the aid of warm water.

A steel bar, of the cylindrical form above described, is, I think, much superior to that of a plane surface for giving a fine edge to a razor or penknife; but it is ill calculated to give a fine point to a lancet, and I therefore cause a plane surface to be made, a quarter of an inch wide, on one side of the bar, by cutting away a part of its substance; and I have found this form to be most extensively useful.

The edge of some razors, whether formed of wootz, of mixed metals, or of pure steel, but particularly of mixed metals, has generally appeared to me to be more keen and active when used a few seconds after it had been applied to the bar, than on the following day; and I have often seen the utmost activity restored to the edge of such instruments, so instantaneously, and by so apparently inadequate means, that I have been sometimes led to suspect the operation of the bar to have been something more than that of having worn away a minute portion of the metal; but I am not disposed to offer any conjectures respecting other effects which I may have conceived it to produce.

I have in many instances been able to give a very fine edge to razors in possession of my friends, which I could not set tolerably well by any of the ordinary means; and I have found that those composed of different materials could be set with equal facility, though the sensations they excited, when used, appeared to me to be in many instances dissimilar. The instruments upon which I have chiefly made experiments, have come from the manufactories of Mr. Pepys, Mr. Stoddart, and Mr. Kingsbury. The material which appeared to me to receive that which I shall call the most eager edge, (and it was very durable,) was wootz, from the manufactory of Mr. Pepys; and that which received the smoothest edge, and which I thought best calculated for surgical purposes, was a mixture of rhodium and steel; the powers of the pure steel of Mr. Kingsbury, appeared to be intermediate; and my experience leads me to believe that, under different circumstances, each of these materials might be used with some exclusive advantages.

[*Journal of the Royal Institution of Great Britain.*

The Chemistry of the Arts, being a practical display of the Arts and Manufactures which depend on Chemical Principles, on the basis of Gray's Operative Chemist. By Arthur L. Porter, late Professor of Chemistry in the University of Vermont. *Carey & Lea,* 1830.

The work, on the basis of which the above treatise has been written, is already advantageously known; the demand for it, even at the expensive rate at which it could be imported, was such as to induce the enterprising publishers, from whose press the work issues, to supply it at a price bringing it more within the reach of those for whose benefit it was especially written. The American Editor has had, abroad, opportunities of inspecting, minutely, the various processes which he has described, and we can but regard the portions coming from his pen, as not the least interesting of the work. Mistakes are corrected, full articles on interesting subjects added to the often meagre results, furnished by the state of information at the time when the operative chemist first issued, and the work concludes with a well arranged detailed statement of the processes of bleaching, dying, and calico printing, contained in more than one hundred pages. The plates, of which there are many, are well executed, and the lettering is generally very correct. The expense of the plates has not been suffered to enhance the price of this book beyond what one should willingly pay for a work important as this; the best and most modern which we have upon the chemistry of the arts.

In order that our readers may be able to judge of the character of the work of which we have just spoken, an extract, from one of the articles of the American Editor, is presented: the article from which this is taken, is on the important art of bleaching.

Bleaching.

Bleaching, in its broadest acceptation, is the art of removing the colouring matter, whether naturally or artificially acquired, from all bodies in the mineral, vegetable, or animal kingdoms. Its most important applications, however, are to those fibrous substances, so extensively used in the fabrication of the clothing of civilized men, cotton and linen, and to these I shall devote the principal part of this article. I shall treat first of the substances, or agents employed in art; and, secondly, of the processes and manipulations, in the order in which they occur.

The materials now used in bleaching are only five in number; viz. water, lime, potash, sulphuric acid, and chloride of lime.

The quality of the water is a consideration of the first importance in the location of a bleachery. No refinement of art has enabled bleachers to surmount the obstacles presented by bad water. Waters impregnated with the muriates, carbonates, or sulphates of lime and magnesia, or with the muriatic, carbonic, or sulphuric acids, in excess, familiarly known by the term, *hard waters*, are unfit for the purposes of bleaching. The small quantity of alkali necessary to precipitate the earthy bases and neutralize the acid, does, indeed, present no serious objection to their use in bucking, nor is there any objection to their use as solvents of the chloride of lime and the vitriolic acid; but their bad washing properties forbids the employment in the dash wheel, where the great demand for water lies. These waters are readily known by the property they have of forming curdy or white precipitates, on the addition of a watery, or alcoholic solution of soap, occasioned by the union of the mineral acid with the alkali of the soap, and the consequent displacement of the oil, which floats upon the surface. The protocarbonate of iron is sometimes found in natural waters, and is very objectionable in bleaching processes. Waters containing this salt exhibit a reddish ochery scum on standing, which is also deposited upon the banks of pools and sluggish streams. The presence of carbonate of iron is detected by the addition of a few drops of a tincture of nut galls, which produces a purple precipitate. The ferro-cayanate, (formerly *prussiate*,) of potash will produce a beautiful blue precipitate, if the water be previously acidulated with a few drops of sulphuric acid. The muriate and sulphate of iron are more rarely found in natural waters, but when they are present, may be detected by the same means. They are alike injurious in bleaching.

Muddy or turbid waters are obviously unfit for the purposes of bleaching, and particularly for the last washings. They may answer for the earlier processes, provided spring or other clear water can be obtained for rinsing. This is the only species of impurity in water which can be remedied by filtration through sand and gravel, which is an indispensable operation on streams whose banks are muddy and liable to frequent and sudden inundations.

The waters of many streams, particularly those which flow through marshy grounds, are tinged of a yellowish or greenish hue, owing to their holding in solution certain vegetable matters. This is one of the most formidable obstacles to a good bleach, and has not yet been surmounted by art.

From the foregoing remarks, it is obvious that the means of judging of the fitness of water for bleaching purposes, are extremely simple, and attainable by every individual, without even the humblest pretensions to science. A water that is limpid and colourless, that does not precipitate an alcoholic or watery solution of soap, (or, in common language, that is *soft* and will *wash well*,) and that is not discoloured by the addition of an infusion of nut gall, or an acidulated solution of ferro-cayanate of potash, or that does not deposit an ochery matter on the banks of water courses,* may be safely relied upon as in every respect well adapted to the processes of bleaching.

Lime suitable for bleaching should be recently and thoroughly burned, and colourless; in other words, lime that is white, and in other respects adapted to masonry, will answer the bleacher's purpose.

Potash, the vegetable alkali, is another important agent in the bleaching art. This article is never found pure in commerce; besides accidental impurities, it is always united, to a greater or less extent, with carbonic acid. Commercial potash is a mixture of pure potash with the subcarbonate of potash, sulphate of potash, silex, minute portions of other earths, and occasionally of undecomposed vegetable matters. These foreign matters exist in very variable quantities in the potash of commerce, and it becomes an important object with the bleacher to find a convenient method of determining the exact amount of real alkali in it, and of course the comparative value of the different lots offered in the market, as a guide to aid him both in his purchases and in the subsequent use of it in his processes. The alkalimeter of Dr. Ure, founded on the quantity of sulphuric acid required to neutralize 100 grains of potash, is a convenient instrument for this purpose. One hundred grains of pure potash will require 105 grains of concentrated oil of vitriol for perfect saturation. The method of procedure is this:—provide a glass tube, sealed at one end, 9 or 10 inches long, and three-fourths of an inch in diameter, and graduate it into 100 equal parts. It is convenient to have the graduation commence a little below the extremity of the open end. The exact contents of this measure is not important, provided the graduation is exact. Such graduated tubes can be obtained at any of the glass houses. Into a tube of this description, introduce 105 grains of concentrated sulphuric acid of a specific gravity, 1.850, or 170° on Tweedale's hydrometer, and fill up the remaining graduated spaces with water; decant the mixture into a wider lipped glass vessel, and stir with a glass rod till the union of the acid and water be complete. Now, as the whole 100 measures contain a quantity of oil of vitriol equivalent to 100 grains of pure potash, it is obvious that each measure of the liquor in the tube is adequate to the neutralization of one grain of potash, and the number of measures required for the neutralization of a solution of 100 grains of any commercial sample is an exact measure of the quantity of real potash contained in it, and, *vice versa*, the number of degrees remaining in the tube is the measure of the impurities contained in the sample. The point of neutralization is ascertained as usual in such cases, by cautious additions of the acids, stirring the mixture on every addition, and trials of the changes of colour produced on litmus and turmeric papers by the liquid. It is proper to caution the operator against a frequent source of error, pointed out by Dr. Henry, in his excellent directions for the manipulations in alkalimetry, from the presence of the disengaged carbonic acid, which, by acting on the litmus paper, may lead him to infer an excess of sulphuric acid. This source of error may be avoided by warming the liquor towards the last of the process, by which means the disengaged carbonic acid is expelled.

---

* The ochery matter frequently observed to be deposited on the banks of rivers from the oozing of minute springs, should not be mistaken for a deposit from the water of the stream itself, as such deposits are generally too inconsiderable to affect the general purity of the water.

Of the oil of vitriol of commerce, one of the next most important agents in bleaching, little need be said. It is generally sufficiently pure as it comes from the manufacturer, for every purpose of the bleacher. It should be colourless, and have a specific gravity of 1.850, or 170° T. If it have a specific gravity greater than that, its purity may be suspected. The usual impurities are sulphate of potash and sulphate of lead. The latter may be detected by a precipitation, on the acid being largely diluted. I am not aware that either have any injurious effect in the bleaching process. But the acidemeter is the readiest method of determining the comparative value of commercial samples, and this is no other than the alkalimeter just described, only reversing the method of procedure;—100 grains of pure potash is to be dissolved in 100 measures of water, in the graduated tube, and portions of the solution added cautiously to 105 grains of the oil of vitriol to be operated on, previously diluted with four or five times its weight of water, till the acid is neutralized. The number of parts, on the graduated tube of the alkaline solution, required for this purpose, will determine the per centage of real acid contained in the sample;—if eighty parts of the one hundred degrees are required for this purpose, then is there eighty parts of real acid in every one hundred parts of the sample.

The last article essential in the bleaching process, is the chloride of lime, or bleaching powder. The introduction of this compound constituted an important era in the history of the bleaching art. What was formerly a work of several weeks, is, in modern bleaching, accomplished in as many days, and with a proportional diminution of labour, and great reduction in expense. The tedious exposures to sun and air, to which, in the old method, the goods were necessarily subjected, are entirely superseded by the use of chloride of lime. The manufacture of this article is described under the head of chloride of lime in this work. It is a dry white powder, having a slight smell of chlorine, and a peculiarly strong, acrid taste, not very unlike the muriate of lime. It is partially soluble in water, to which it imparts its smell and bleaching power. The undissolved portion is an hydrate of lime united with a small proportion of the chlorine. The value of chloride of lime depends wholly on the amount of chlorine it contains. We meet with very variable proportions in the commercial specimens. Bleachers generally judge of the strength from the specific gravity which it imparts to the watery solution. If the powder be dry and have the odour and taste of a good article, the specific gravity is not an indifferent measure, though I have not found it uniformly correct. 5 lbs. of the best bleaching powder should impart to its solution in an ale gallon of water, a specific gravity of 1.025, or 5° T. But a more correct test of the value of this article is to be found in its power of discharging the colour from a diluted solution of indigo in sulphuric acid; for directions for using this test the reader is referred to the article, which treats of the manufacture of bleaching powder in this work. It ought to be known to the bleacher that chloride of lime loses strength by exposure to the air, and to a certain extent even when it is kept in close casks; by free exposure to the air the chlorine escapes, or rather is expelled from the lime by the joint operation of the carbonic acid and moisture of the atmosphere, and a carbonate instead of a chloride of lime remains; no more than one cask, therefore, should be allowed to be open at any one time, and that should be kept as much excluded from air and moisture as possible.

I will now proceed to describe the various processes of the art in the order in which they occur in the bleaching of cotton shirtings and sheetings.

The Steep.

The goods as they come from the loom are impregnated with flour, paste, or starch, used in the process of manufacture. To free them from this foreign matter, they are thrown in loose bundles, each piece by itself, into any large vessel, or cistern, capable of containing the quantity to be operated on, which I will suppose throughout this treatise to be one ton nett, or 2000 lbs. The form of this vessel is a matter of no importance whatever; a common wooden cistern, such as is used for the scouring and bleaching liquors, will answer every purpose, provided there is a means of warming the water in winter by steam; but if this cannot be conveniently done, a spare bucking keir may be made use of when artificial heat is required. On the introduction of every layer of cloths, sufficient water should be admitted into the steeping vessel to wet them, and, in order to secure this object effectually, while one man is employed in putting the goods into the cistern, another should tramp them into the water. It is better that no more water should be used than is sufficient to cover the goods when pressed down. In this state the cloths should remain till a gentle fermentation is produced, which may be known by the appearance of a frothy scum upon the water, and a sour smell from the cistern. In fact the acetous fermentation of the paste, and perhaps some vegetable principle of the cotton along with it, has taken place; its elements have assumed new combinations, and become more soluble in water. It is probable also that the acetous acid which is formed, may, at this early stage, exert a highly beneficial solvent power on the natural colouring matter of the cotton. The time requisite for the steep depends much on the season of the year, or rather on the temperature to which the goods are exposed; during the summer months, twenty-four hours, and sometimes less, will be found sufficient for this purpose; in spring and autumn, from one to two days are necessary; and in winter, artificial heat is indispensable to despatch in business; the acetous fermentation is very sluggish below 50° Ft.: it takes place readily at 60°, but does not attain its greatest activity below 80°, or perhaps 90°. When artificial heat is used, care should be taken not to allow a temperature approaching to a scald, which is supposed to produce a change on the starch or paste, unfavourable to the necessary fermentation when the proper temperature is afterwards acquired. It is scarcely necessary to remark, that the steeping process, if carried too far, would endanger the strength of the fabric. Some bleachers employ for the steep the spent alkaline leys, instead of clean water; a practice highly objectionable; 1st, because it retards the fermentation; 2nd, because this alkaline liquor is already loaded, perhaps saturated with the colouring matter of the cloth, and would be more likely to deposit than to take up an additional quantity at the low temperature of the steeping liquor; and, thirdly, because the acetous acid of the fermentation must, by combining with the alkali of the ley, have the direct effect of precipitating the colouring matter, with which it was previously united, directly upon the cloth. It is a singular circumstance that a practice so fraught with objections, and so opposed to the ac-

acknowledged theory of bleaching, should have been either passed over in silence, or noticed with commendation, by all the respectable writers who have treated of the subject. The fermentation of the *steep* might be greatly expedited by the use of a very small quantity of yeast made from damaged flour, which might be deposited near the centre of the lot; but in this, as in the introduction of the slightest innovation upon established practices, the enlightened bleachers may calculate on encountering the prejudices of old workmen in the art. After the steep, the goods are to be opened out of the band, or bundle, in which they are usually made up, and well washed in the dash wheel. Some bleachers improperly omit this washing.

[TO BE CONTINUED.]

On the Setting of Plaster of Paris. *By* M. GAY-LUSSAC.

EVERY body knows the property of plaster, deprived of water by heat—of forming a hard body with that liquid. The consistence which it acquires is very variable, and those are decidedly the purest plasters which set with the least water. The cause has been attributed, for that of Paris, to the presence of a few parts per cent. of carbonate of lime, but doubtless very erroneously; for the heat necessary to bake plaster, which, on a small scale, does not rise to 150°, (= 302° Faht.) is not raised, in the large way, to the degree necessary for decomposing carbonate of lime; besides, baked plaster does not usually contain free lime, and the addition of that base to plasters of little consistence does not perceptibly improve them. I think that the difference of the various degrees of consistency acquired by baked plasters with water, must be sought in the hardness which they offer in the raw state; a hardness we cannot explain, and which must be taken as a fact. This laid down, I conceive that a hard plaster stone,* having lost its water, will acquire again more consistence in returning to its first state, than a plaster stone naturally soft; it is, in a manner, the primitive molecular arrangement which is reproduced. Thus, we see, good cast steel, from which its carbon has been taken by cementing it with oxide of iron, give, afterwards, by a new cementation with carbon, a steel much more homogeneous and more perfect than that which would be obtained, in the same circumstances, by the cementation of iron.

[*Ann. de Chimie.*

Dying of Silk a Permanent Chrome Yellow. *By* M. OZANAM.

CLEANSE the silk at one heating of two hours, wash and wring it; plunge the skeins in a solution of sub-acetate of lead more or less strong, according to the desired depth of yellow. At the end of two hours take them out, expose them to the air for half an hour, then wash them in a stream and wring them.

---

* What is commonly called plaster stone, (pierre a platre,) consists of impure masses of sulphate of lime. It is usually mixed with clay, sand, carbonate of lime, and contains animal and vegetable remains. The sulphate of lime contains twenty-one per cent. of water of crystallization. It is softer than marble in general.—See Thenard's Chemistry, II.—TRANS.

Prepare a bath, in which a sufficient quantity of neutral chromate of potash, (about from the fifteenth to the twenty-eighth part of the weight of the silk,) is dissolved. Neutralize the bath with half a glassful of hydrochloric, (muriatic,) acid. Leave your silks in it, during half an hour, at the mean temperature: twist or wring them over the liquor, and wash them in a slight solution of soap, just warm, then in a stream of cold water.

The shades of yellow are varied by altering the quantities of the mordant of sub-acetate of lead, and of the chromate of potash, which must always be deneutralized by hydrochloric acid.

[*Recueil Industriel.*

Maryland Institute.

We learn with great pleasure that our sister institution, the Maryland Institute, is in a prosperous condition, and pursuing with activity a course of great usefulness.

This society was founded in November, 1825. Its objects are the encouragement and promotion of manufactures, and the mechanic and useful arts, by the establishment of popular lectures upon the sciences connected with them; by the formation of a library and cabinet of models and minerals,—by awarding premiums for excellence in those branches of national industry deemed worthy of encouragement—by examining new inventions submitted for that purpose—and by such other means as experience might suggest.

In January, 1826, a bill incorporating the Institute, passed both branches of the legislature of Maryland. In the course of the same year, several lectures were delivered by gentlemen, who volunteered their services for this purpose; an exhibition of the products of our mechanical industry was also announced.

The encouragement which was given to the new institution in its incipient state, justified the exertions that were made by the Board of Managers to place it immediately on such a footing of usefulness, as alone could impart to it stability and permanency. To produce this effect, no expenditure of time or money, consistent with the hopes which were justly created by the general interest manifested in behalf of the institute, was spared.

The Managers adopted measures to procure, as early as possible, an extensive apparatus, by means of which the lecturer could make all the necessary illustrations of the fundamental principles of mechanical and chemical philosophy. This having been obtained, the lectures, which had been partially suspended for want of the necessary apparatus, were resumed early last winter, and judging from the manner in which they were attended, appear to have given satisfaction.

Through the exertions of our worthy and efficient delegates, an annual appropriation of three hundred dollars was made by the legislature. The lecture room has been so fitted up, as to afford comfort to the auditors, and enable the lecturer to carry on his demonstrations to the advantage of the respective classes.*

Mr. Julius T. Ducatel has been appointed to lecture on natural philosophy and chemistry.

The number of subscribers to the society has increased, and the Managers and officers have, we learn, resolved to spare no exertions to secure to the public all the benefits originally contemplated on the foundation of the institution.

The following report will show the prosperous condition in which the Institute commences the operations of its sixth year of existence, and we wish every success to its laudable exertions.

Report of the Managers of the Maryland Institute.

The Board of Managers of the Maryland Institute for the promotion of the mechanic arts, deem it proper, at the commencement of another season of lectures, thus publicly to address the members, and the public generally, on the subject of the Institute committed to their charge. With varying success, this has continued from year to year, until it has become finally, and it is hoped permanently, established. Its object is by this time, too well known to need detailed explanation; it is sufficient to say, that, as its title purports, it aims, and has constantly done so, at the improvement of the mechanic and manufacturing arts, by placing the aids of the science connected with them, in the easy reach of their practisers and professors. Nor, is it believed, has it been altogether without useful attendant results.

The Maryland Institute, however, like many public establishments, lives on the health of public favour, with a better chance of continued existence perhaps, from the fact, that it does not call upon the *charities* of the community, but urges it on the score of its *interests*. To the members and to the public, the Board of Managers, therefore, now address themselves.

During the last winter, the chairs of chemistry and natural philosophy applied to the arts, were respectively filled, and full courses of lectures were delivered on these branches of science. The lecturers were the better enabled to effect this from the excellent accommodations in the Athæneum, and from the apparatus received from France, of a superior kind, and forming the chief part of an order, which, when it is all received, will make the apparatus of the Institute as full and complete as could be desired. The classes which attended the lectures were numerous, attentive, and composed of those who came to learn, and whose learning, when obtained, would be made of use and value, by their industry and intelligence. The drawing school under the direction of Mr. Smith, one of the ablest teachers in the country, and the secretary of the Board of

---

* Chronicle of the Times. Edited by J. T. Ducatel and G. H. Calvert.

Managers, was opened during the winter, under the auspices of the Institute.

Owing to the exertions of the delegation from this city in the legislature, this body appropriated the sum of three hundred dollars annually to the use of the Institute, so long as it shall be in efficient operation. This sum, though small, is satisfactory, both in the pecuniary assistance which it affords, and the interest which it evinces on the part of the state, in the success of the institution. Depending too for continuance upon the permanent efficiency of the Institute, it will act as a spur to the friends of the latter, to prevent the aid thus given, from being forfeited by neglect or inattention.

The Board of Managers, in making their arrangements for the ensuing season of lectures, deemed it expedient to unite the two chairs of chemistry and natural philosophy in one person, and appointed Professor Ducatel, of the University of Maryland, to take charge of them. With the talents and acquirements of this gentleman, the Board have every reason to be satisfied, and in their opinion on this subject, they are fully supported by the numerous audience which attended his lectures during the last winter. He will now lecture four times a week, twice on chemistry, and twice on natural philosophy. The Board have reason to believe that the remaining evenings of each week will be filled by occasional lectures from gentlemen of acknowledged ability, upon interesting subjects, so that the lecture room of the Institute, during the four winter months, will present a place of resort of the most agreeable and instructive character, where information and amusement may be readily and cheaply obtained. Mr. Smith will again open the drawing school, and when his own abilities, and the excellent collection of models of the Institute are considered, it is hoped that his class will be as numerous as the importance of the subject of his instruction ought to lead us to anticipate.

The contribution to entitle a person to the privilege of membership, is still three dollars, for which all the advantages of the Institute, except the drawing school, are obtained.

Connected with the Institute, is the Apprentices' Library, containing a numerous collection of works peculiarly adapted for the members of this Institution, and which the Board have now made arrangements to put in active circulation.

The Board of Managers confidently hope, that the Institution which has thus far existed, and added its portion of useful duty to the public, will still receive a general, liberal, and willing support.

J. I. Cohen, Jr. *Chairman.*

On the Making of Charcoal.

The subjoined notice has been going the rounds of the European and American Journals, without a single remark in either of them, respecting the author of the improvement to which it refers.

"*Manufacture of Charcoal.*—A new process, recommended in the

Journal des Forêts for this purpose, is to fill all the interstices in the heap of wood to be charred, with powdered charcoal. The product obtained is equal in every respect to cylinder charcoal; and independent of its quality, the quantity obtained is very much greater than that obtained in the ordinary method. The charcoal used to fill the interstices, is that left on the earth after a previous burning. The effect is produced by preventing much of the access of air which occurs in the ordinary method. The volume of charcoal is increased a tenth, and its weight a fifth."

The discoverer of the foregoing method of making charcoal, was Mr. Marcus Bull, of Philadelphia. The process was published in the Franklin Journal, for June, 1826, vol. i. first series, p. 358. By the following extract it will be seen that the foregoing account, from the *Journal des Forêts*, is given nearly in the words of the original publication.

"In the paper of Mr. Bull on the subject of fuel, that gentleman has described his method of obtaining charcoal, by surrounding the pieces of wood to be charred, with pulverized coal, by which a product is afforded equal in every respect to that made in cylinders, or retorts of iron. The Editor has seen some of the charcoal made upon this plan, in the large way; its superiority to that produced by the common process was very striking. The plan proposed can be pursued with facility and without expense, and the great saving of wood from the increased quantity obtained, is a circumstance which renders it of national importance."

Mr. Bull says, "it occurred to me that an important improvement might be made in the common process of making charcoal, by filling the interstices between the sticks of wood, with the culm, or fine coal, left on the ground after the large coal has been drawn from the pit; and by covering the wood more perfectly than is usually done. In this way we may more completely prevent the access of air, which is not only destructive, in many cases, to a large portion of the coal, but also renders what remains less valuable."

"An intelligent collier in New Jersey applied, in a partial manner, the plan proposed. He found the product to be about 10 per cent. more in quantity, *by measure*, than he had ever before obtained from the same kind and quantity of wood; and I also found the coal when brought to market, nearly 20 per cent. heavier than usual."

[Editor.

Shell Lac and Seed Lac. Reply to Query.

By turning to page 102 of the Franklin Journal, vol. ii. first series, the subject of seed lac and shell lac, as applied to varnishes, will be found to be treated at some length. The manufacturing of sealing wax. The application of shell lac to the stiffening of hats, and various modes of bleaching this resin, have also been fully made known in this work. We wish that "Many Manufacturers" would purchase the volumes, and examine for themselves.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

FEBRUARY, 1831.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1830.

With Remarks and Exemplifications, by the Editor.

(Concluded from page 16.)

91. For improvements in *Machinery used in Steam Navigation;* Franklin G. Smith, Lynchburg, Campbell county, Virginia, October 12.

Plates to accompany the specification of this patent are in the hands of the engraver.

---

92. For an improvement in the *Mould or Instrument for Pressing Pine Apple Cheese;* Myron Norton, Goshen, Litchfield county, Connecticut, October 13.

Instead of the netting usually employed to mark the lines upon pine apple cheese, moulds are to be made, of wood or metal, cast iron being preferred. Upon the insides of these moulds the requisite pattern is formed, by carving or otherwise. The moulds are made in three parts, and, when used, are confined together by proper bands. A tubular opening is left at the lower part of the mould, to fill it with curd, and into this a follower is fitted for the purpose of making pressure.

The claim is to "the substitution of the mould of metal, or wood, carved, or cast in manner and form described; and the manner or principle of giving the stamp or impression in the cheese by said mould, at the time and in the process of pressing, thereby superseding, and eluding the use of the net formerly used for giving the impression."

Although we are impressed with the idea of having seen pine apple cheeses, the pattern of which had evidently been given by the form of the mould, we are not able to assert it as a fact. We, however, have seen many cheeses made in moulds in which devices had been carved; and they are quite common in some countries. The present patent, therefore, must stand upon the claim of the particular pattern of the mould, being that of a pine apple.

---

93. For an improvement in the mode of *Constructing the Fancy Card of the Carding Machine;* Phineas L. King, of Sparta, and Enoch Blasdel, of Lawrenceburgh, Dearborn county, Indiana, October 14.

(See specification.)

---

94. For a *Washing Machine;* John Freeman, Senate, Cayuga county, New York, October 14.

There is a trough into which the clothes are to be put. Within this trough are two carriages, placed side by side; the lower sides of the carriages are furnished with fluted rollers, and they are driven alternately backwards and forwards by means of a crank. The clothes being placed within the trough, the carriages are put in motion, and the action of the rollers is to produce the desired effect.

"I claim as my improvement, the principle, and the moveable carriages with fluted rollers, as new, and heretofore unknown and unused."

---

95. For a *Revolving Steam Washer;* James Barnes, Kingston, Luzerne county, Pennsylvania, October 14.

This "Revolving Steam Washer" is a common barrel churn, with pins projecting through one of the staves into the barrel, to raise the clothes as the barrel revolves, and cause them to fall down into the suds. What constitutes it a *steam* washer, or what it possesses of novelty, would be news to us.

---

96. For a *Machine for Sawing Felloes* for the wheels of carriages; Alvan Colbry, Sharon, Windsor county, Vermont, October 15.

Several patents have been taken for machines for sawing felloes. The present machine differs but little from some which have preceded it, and the only thing claimed as new, is the method of returning the carriage after the felloe is sawed. The plank to be sawed is placed upon a carriage, confined by a pin at the centre of the curvature of the felloe. There is a rack upon the lower side of the carriage, and a pinion taking into this rack causes the carriage to advance; it is made to return by throwing this pinion out of, and another which operates in the reversed direction, in gear; a kind of movement common in machinery.

It frequently happens that after examining the papers and models in the patent office, applicants for patents find that they have been anticipated in their inventions, and therefore omit a part of the claims they had intended to make. We do not know that this was the case in the present instance, but from the smallness of the pretensions set up, it might fairly be inferred. The general principle of the machine has been so long known, as to have become public property.

---

97. For an improvement in the *Saw Set;* Ebenezer Whiting, Berkshire, Tioga county, New York, October 15.

(See specification.)

---

98. For a *Machine for Spreading Lime, Plaster, &c. on Land;* Andrew Krauss and Joel Krauss, Upper Milford, Lehigh county, Pennsylvania, October 16.

The lime, or plaster, in powder, is put into a wagon constructed for the purpose. Across the hinder part of the bed of the wagon, near the tail board, there is an opening extending from side to side. A roller fixed upon gudgeons, below the wagon bed, nearly fills up this opening. On the end of the axle of one of the hind wheels a pulley is placed, from which a band extends to another pulley on the axis of the roller, to cause it to revolve; the axis of the hind wheels revolves with them, for the purpose of communicating this motion. As the roller turns, it draws after it a portion of the article to be spread upon the land. The claim is to "the machine as above described, for spreading lime, plaster, &c. on land."

---

99. For a *Machine for Washing Clothes;* William H. Brainard, of Haddam, and Chauncey B. Bulkley, of Chatham, Middlesex county, Connecticut, October 16.

A trough is made to contain the articles to be washed; dashers are caused to vibrate in this trough, by means of two levers, worked like pump handles, one in each hand. The specification contains about as many pages as we have devoted lines to the description; we, however, will afford room to the claim, which is as follows.

"What we claim as new in the above described machine, is the arrangement of the various parts which constitute the same, in the manner above specified, and the application thereof, and of the powers and principles embraced in the operation of said machine, in the form and method above set forth, for the purpose of washing clothes."

---

100. For an improvement in the *Production of Light,* by a combination of liquids; Isaiah Jennings, City of New York, October 16.

This patent is taken for a material which is to be substituted for oil in common lamps. The material is a mixture of alcohol and spirits of turpentine.

"To produce light from alcohol and spirits of turpentine, mix equal or unequal parts of each, agitate them that they may mix together; let them stand awhile, and the alcohol will be combined with a small quantity of turpentine, and the remainder will be separated; draw off the alcohol, and the small portion of turpentine combined, which is about one-eighth part, and it will be ready for use.

"I claim the admixture of alcohol with spirits of turpentine, and its application to common lamps, with or without wicks."

We have seen the above mixture in combustion in an Argand's lamp. The flame was clear, dense, and brilliant. The light may be made greatly to exceed that from oil, without the escape of any smoke; and there is not the slightest odour of the turpentine. The patentee says the mixture is as cheap as spermaceti oil, and that he is making arrangements which will enable him to afford it at a cost considerably below that material. The wick is scarcely blackened by the combustion; there is no dripping from the lamp, and no grease.

Chemists knew the fact that alcohol and spirits of turpentine would combine, and burn with a bright light; but we are not aware of their having been proposed to form an article for the supply of lamps, and one which might be advantageously employed in domestic economy. The patentee has used this composition with a wire wick, and has found it to answer well. Fibrous asbestos would probably be preferable, but this is a point of mere curiosity, as cotton wick is always at hand, and none better need be desired.

The friends of temperance will not object to the burning of alcohol.

---

101. For an improvement in the *Grist Mill;* Ephraim Griswold, Truxton, Courtland county, New York, October 16.

The runner of this mill is made conical, something like the common steel mill. This is to fit into a hollow conical piece, which forms the bed. The runner and bed are to be made altogether of stone, or they may be formed in part of cast iron, with pieces of burr stone fastened on them by screws.

The axis of the runner is placed horizontally, and an opening is made through the side of the hollow conical piece, to feed the mill stones. This opening is near the inner, or small end, of the cone; the termination of which is not to be in a point, but in a segment of a globe.

"The invention here claimed is the general construction of the mill as above described; particularly in the manner of making the runner and bed of stone, or of burr blocks screwed on cast iron for that purpose."

The general construction is not new. The conical form, the feeding in the manner described, and the making such mills of stone, are circumstances in all of which the present patentee has been anticipated. What he more particularly claims, the screwing of burr blocks to iron, is, we apprehend, the only point of novelty.

102. For an improvement in the mode of making *Glass Door Knobs;* Deming Jarvis, Boston, Massachusetts, October 19.

These knobs are perforated in the usual way, to receive the spindle, which is to be square. A square cavity, about a quarter of an inch deep is sunk at each end of the knob, to receive a square collet, which will prevent the knob from turning. In all other respects the knob is made in the common form.

103. For an improvement in the *Manufacture of Oil from the Sun Flower;* Charles A. Barnitz, Spring Garden, York county, Pennsylvania, October 20.

This *improvement* consists in following the old mode of hulling, breaking, and pressing seeds to obtain their oil. There is not the slightest pretension to novelty, but it is presumed that the patentee simply means to secure to himself the right of doing that which is known all over the country, and has been practised both here and in Europe.

104. For an improvement in the manner of *Manufacturing Brads from Iron Plates;* Edmund Gamman, Gorham, Cumberland county, Maine, October 20.

A strong iron shaft is to have projecting rims upon it, around which rims are placed steel cutters, in number from six to twenty. The cutters are tapered in reversed directions, alternately, according to the taper of the brad. The stationary, or bed cutters, are to be made to vibrate by means of cams. The particular construction of this part of the machine does not appear in the drawing, and is very obscurely described in the specification. The iron plates are to be carried towards the cutters by feed rollers.

The whole machine appears to be considered as "the improvement," as there is no particular claim to any part. Circular brad and nail machines, with the revolving cutters fixed in the manner described, have been repeatedly tried; they have not however been found equal to the ordinary vibrating machine, nor do we believe they can be made so.

105. For a combination of machinery for *Thrashing Grain, Shelling Corn, Cutting Straw, and Grinding Provender;* Benjamin D. Beecher, Woodbury, Litchfield county, Connecticut, October 20.

This is a sort of *omnium* machine, the novelty of which consists in uniting several different machines together.

The claims made are to "the particular form of the beaters; the manner of making the concave; driving the feeding roller by the main band; the apron by the main shaft; and the mode of combining the several pieces of the machinery."

The cylinder has iron beaters on it which are bent in the form of a V; that, in beating, the angular point may first meet the grain to be thrashed; the hollow segment, or concave, is formed of thin plates of iron, placed between strips of wood. The shelling part is made like the well known corn sheller, consisting of a circular disk with teeth on its side. Towards the centre of this wheel cutters are placed, for cutting straw; when thus used, a trough is added to feed from. Still nearer the centre is to be a furrowed, cast iron plate, running against a corresponding plate, for grinding provender. We have heard of instruments furnished with so many conveniences that it was quite inconvenient to use them; this objection, we suspect, will lie against the contrivance of which we have spoken, and it will not stand alone, as "the *particular* form of the beaters," and some other *particulars* named, are by no means new.

106. For a machine for *Sawing Felloes for Carriage Wheels;* David D. Hanson, Weare, Hillsborough county, New Hampshire, October 20.

This machine bears a strong resemblance to that described, No. 96. There is, of course, some difference in the arrangement. The improvements claimed are the manner in which the part called the sweep is constructed, together with the vice and gauge pullies. These particular parts we do not think it necessary to describe, not perceiving any thing in them worthy of special notice.

107. For an improvement in the *Water Wheel;* Henry Overvill, Richland, Oswego county, New York, October 21.

This water wheel is similar to one which we described in our last volume. The leaves, or buckets, are hung like shutters, and are intended to open by the force of the current, when moving with it, and to close in their opposite motion. Such buckets, variously hung, have been reinvented over and over again. The contrivance is one of the first suggestions to the minds of those who are in search of a current wheel, and who are uninformed respecting previous failures in the same search. The phantom is destined to be again called from the shades, and again to disappoint the exorist.

108. For an improvement in the machine for *Carding Wool,* and other fibrous materials; Calvin Wing, Gardiner, Kennebeck county, Maine, October 21.

This carding machine has been fairly tested, and is highly spoken of, both as regards the goodness of the work performed by it, and the saving of labour, which is said to be equal to more than one-half. We cannot describe its various arrangements, intelligibly, without a plate, and therefore will not attempt it, particularly as we may hereafter be enabled to give it with the requisite illustrations.

109. For an improvement in the *Water Wheel, by Casting it in one entire piece; and also in the mode of Casting the*

same; Calvin Wing, Gardiner, Kennebeck county, Maine, October 22.
(See specification.)

110. For an improvement in the *Mode of Boring the Earth for Water*, and for other purposes; William Morris, Jr. and Jabez Spinks, Kenhawa county, Virginia, October 22.

The principal object of this machine, we are told, is the employment of horse power, which is applied as in the common horse mill. The horse being geared to a sweep attached to a vertical shaft.

Over the well, or place to be bored, a scaffolding is raised consisting of four poles 40 or 50 feet in length, and placed rectangularly, suitable cross pieces being used to bind them together. The drill is made to rise and fall by means of a horizontal shaft acted upon by the periphery of the horizontal wheel, turned by the horse; and by means of a rope passing over a pulley at the upper part of the scaffold, the auger may be withdrawn.

111. For improvements in the construction of the *Water Wheel*, and in its application to the driving of machinery, by the *reaction of* water; Calvin Wing, Gardiner, Maine, October 22.
(See specification.)

112. For a *Bedstead, called a Metamorphosic Alleviator;* Jonathan Lowe, Vienna, Oneida county, New York, October 25.

This is one member added to the family of bedsteads designed for the accommodation of persons confined to bed. We have recently noticed two patents, having the same object in view, and a volume might be filled with descriptions of similar contrivances. In the case before us, the platform, or bottom of the bedstead, is divided into three parts; the head part is made to elevate, and the foot part may be depressed, there being joints in the side rails for that purpose. The legs, at the foot, are made capable of bending underneath to allow of this depression. The centre part of the side rail is furnished with legs, independent of the head and foot posts, to sustain the bedstead when the latter are off the floor. Rollers, ropes, pullies, &c. are used to give the required elevation or depression.

There are so many ways of effecting the purposes intended by this bedstead, and they have, indeed, been so frequently effected, that there ought to be something special in the construction of an apparatus of the kind for which a patent is taken. The present patentee appears to consider as new, all that he describes, as, if there is any thing which can be called a claim, it is in the following words.

"For all which improvement in the construction and use of the common, French, field, high post, and other bedstead, the inventor most respectfully solicits the patronage of the proper authorities, by granting him letters patent, agreeably to the acts of congress in such case made and provided."

113. For an improvement in the *Machine for Inking Forms of Type*, or letters, &c. when worked, or printed on a common hand printing press; Samuel Fairlamb, City of New York, October 25.

The patentee has occupied eleven pages in the description of his apparatus, with an additional page of references to the drawing. The claim is of considerable length, and would not be understood if given alone. Since the patent obtained by Mr. W. J. Stone, in Oct. 1829, three or four differently constructed inking machines have been patented, which have been duly noticed. The present is less complex than some of its predecessors, but it has no superiority in this particular over that of Mr. Stone. The only true test of comparative merit, is a fair trial, which has not yet been given to Mr. Stone's machine.

LIST OF PATENTS WHICH ISSUED IN NOVEMBER, 1830.

With Remarks and Exemplifications, by the Editor.

1. For a *Machine to Pick up Apples from the Ground*, under the trees; Samuel Laning, Camden, Gloucester county, New Jersey, November 1.

This machine is to be driven on by handles formed like those of a wheel barrow. A drum, or cylinder, stands in the place of the wheel, extending across the machinery, and being about 16 inches long. The heads of this cylinder form projecting rims extending three inches beyond the cylinder; these rims serve as wheels to the picking machine, and sustain the cylinder at the distance of three inches from the ground. Pointed wires serve as pickers, by running into the apples. A comb above the cylinder removes the apples from the pickers, and conducts them down into a basket suspended to receive them, which, when filled, is to be replaced.

The claim is to "the employment of a cylinder with pickers for the purpose of picking up apples from the ground, and the comb, or slats, for taking the same from the pickers, and delivering them into a basket, in the manner, and for the purposes herein described."

2. For an improvement in the *Apparatus for Boring the Earth for Water;* Levi Disbrow, City of New York, November 1.

(See specification.)

3. For a *Machine for Cutting Tenons on Carriage and Wagon Spokes;* Andrew P. Smith, Cornwall, Litchfield county, Connecticut, November 1.

The patentee has described this machine at much length, so that we think the description is obscured by its minuteness. The tenons it appears are to be cut by a jointer furnished with an askew iron. The shoulder is to be cut by a saw extending from the angle of the jointer a little above the face of the iron. The jointer is made to traverse between horizontal cheeks, by a crank and pitman at one end of the frame. There are certain other appendages to hold the spoke, and regulate the cutting. The mode of operation differs from that of several other machines for the same purpose, but we do not perceive its points of superiority. The whole apparatus is patented, no claim being made.

---

4. For an improvement in the *Lever Press;* Hazard Sherman, Scriba, Oswego county, New York, November 1.

This press acts upon the familiar principle of a combination of levers. There is a bed piece, or sill, from the ends of which rise two uprights with slots and holes to fix the ends of the levers, and form their fulcra. The patentee says, "what I claim as new, and as my own invention and discovery in this press, and for which I now ask an exclusive privilege, is the particular method of applying the increased power obtained by the multiplication of levers bearing upon each other, as described in the above specification, and illustrated in the drawing."

We are quite unable to ascertain in what the discovery here claimed consists; but we think there would have been just as much wisdom in *claiming the increased friction*, as the *increased power.*

---

5. For an improvement in the *Machinery for taking the Wool from the Wool Carding Machine;* Charles Atwood, Middletown, Middlesex county, Connecticut, November 1.

"This improvement consists in placing a trumpet formed tube, having a rotary motion, at or near the end of the doffer, at each end of a wide machine, or one end of a narrow one, at a distance of about two inches from the face of the doffer, with its centre about level with the lowest action of the comb, at right angles with the doffer. The tubes turn into stands bolted on the top of the plate of the carding machine, projecting inwards, and are motioned as hereafter described. When the wool by the natural action of the comb has formed a roll of sufficient size for a sliver, or thread, the out end is passed through the tube, to a pair of rollers placed before it, having a speed sufficient to take it away. The lower of these rolls is on a shaft passing across the carding machine, having its bearings cut into the top of the plates, with two rolls on it of about four inches in diameter, and six inches long, placed directly before each tube, with their upper surface level with the centre."

We have copied so much of the specification to afford a general idea of the plan pursued; and can do no more without giving the whole with the drawings. The latter are but very indifferently executed, but still suffice to make known the *general* arrangement of the machinery.

---

6. For an improvement in the *Machine for Winding the Shubbing, or Roving made from the Carding Machine, upon*

separate Spools, or Bobbins without Heads, called the Conical Spool Winder, for slubbing from the card; Charles Atwood, Middletown, Middlesex county, Connecticut, November 1.

We cannot attempt a description of this machinery, without giving drawings; nor can we furnish the claim of the patentee, as he does not make any.

---

7. For a *Method of Moulding and Drying Brick;* Charles Vasser, Poughkeepsie, Dutchess county, New York, November 1.

The brick moulds are to have projecting edges of steel, and the stock is to be of metal, or covered with metal. Each brick when moulded is to be turned out upon a smooth board, a little larger than the face of the brick. These boards, with the bricks upon them, are to be arranged upon shelves in a drying shed. The roof of this shed is to be close, and the sides furnished with falling shutters to keep out the rain, &c. when required.

The foregoing is the substance of "Vasser's new and useful invention for moulding and drying bricks." There is no claim. We are not quite sure that moulds lined, as we have seen them, with iron, are not as good as those above described. Sheds with close roofs and side shutters are not new, and would be generally used were not economy too much considered. The plan of a separate board upon which to dry every brick, we suppose is new, but doubt its adoption.

---

8. For an improvement in the *Plough;* Samson Felton, Huntington, Huntington county, Pennsylvania, November 1.

No attempt is made in the specification to designate any thing in the form of this plough, that is different from that of other ploughs; but the mould board and land side are to be in part of cast iron, and in part of wood. The share is to be of wrought, or of cast iron. The claim rests upon these circumstances, and upon the manner of putting the whole together.

---

9. For a machine for *Thrashing Grain and Shelling Corn;* Edward Thurston, City of New York, November 1.

This machine is to have a cast iron cylinder, which is to be fluted, or ribbed, from end to end. There is also to be a hollow segment similarly fluted. This hollow segment is to be borne up against the roller by spiral, or other, springs, and is fixed upon a frame, to which a weight is hung, to co-operate with the action of the springs. The claim is to the combination of the balance and spring bed, and to the entire cast iron cylinder.

---

10. For a mode of *Preserving Rope and Cordage;* Amos Salisbury, Troy, New York, November 1.

If we understand this patent, tarred ropes must no longer be made without first acquiring a right from the above named gentleman.

He says, "my improvement consists in saturating the rope or cordage, or the material of which it is made, with oil, fat, or other *unctuous substance*, or applying such quantity of oil, or unctuous substance, as shall be deemed necessary to answer the purpose intended."

It will behoove Mr. Converse, the townsman of the patentee, to see that, in his candle factory, the workmen in his employ keep clean hands, or he may be fined for having his ropes saturated with tallow.

11. For a *Machine for Facilitating the Washing of Ores and Alluvial Soils*, and the extraction of metallic substances and precious stones from ores, earth, sand, or other matter in which they may be found. Issued according to a special act of congress, passed May 28th, 1830, to Vincent de Rivafinole, late of England, but now of Mechlenburg county, North Carolina, for himself, and as attorney in fact for Charles Harsleben and William Davis, of the kingdom of Great Britain, November 1, 1830.

We have seen this machine in actual operation, and on a former occasion adverted to it in terms of commendation.

The apparatus consists of a conical tub, or other suitable vessel, placed *vertically*. A double shaft passes down the centre of the tub, which carries metallic dashers, or agitators, which are turned by means of a crank. The shaft is made double, consisting of a solid rod turning in a tube, to carry two sets of dashers with different velocities. The pulverized mass intended to be washed, is put into the tub, with some water. On turning the dashers with a proper velocity, the water will be thrown towards the outside of the tub, and the contents will assume the form of an inverted cone, to the lower end of which gold, silver, or other weighty articles will descend. There is under the centre of the tub, a metallic chamber, and a valve, which, when opened by means of a lever, will allow the heavy substances to descend into the chamber, and upon opening a second valve, they will fall from this chamber into any vessel placed below it.

When the agitation has been continued a sufficient length of time, the valve is opened, but the agitators are still kept at work. The chamber fills with a portion of water and with the heavy substances; the valve is immediately closed, and the contents of the chamber taken out; when the metallic or other ponderous matter which the earth contained, will be found therein.

The claim is to the double agitators, and to double or treble valves, to allow the washed materials to be collected.

12. For *Lock Paddle Wheels*, for propelling canal and other boats; H. L. B. Lewis, Buffaloe, Erie county, New York, November 2.

The paddle wheels described in Mr. Lewis' specification, are to have the buckets hinged. The shaft, or middle part of the wheel is to be a cylinder, or drum, to which the rims of the wheels are to be attached, leaving no place for the escape of water, either at the sides or towards the centre of the wheel. In order to enable the buckets to fill with water, a space is left, between each bucket and the cylindrical drum, just sufficient to allow of the escape of air, for that purpose. The gudgeons upon which the buckets turn, are to pass through the sides, or rims of the wheels; and arms, from them, work in grooves attached to the framing, or are operated upon by cams, or pins, to cause the buckets to lock and unlock, close or open, at the moment desired, and to assume an angle which may be thought best.

The claim is to "the locking or unlocking of the floats at any point required;" to the forming of the wheel with a cylinder, or drum, as described, with solid or close sides to prevent the escape of water, either laterally or vertically; and to the edges or rims of the wheels projecting beyond the outer edges of the paddles, for the purpose of checking, or preventing the agitation of the water, in order to prevent the banks of canals from washing.

---

13. For a *Sawing and Planing Machine;* Thomas Bloomer, City of New York, November 3.

This may be a very good machine, but it is not explained with sufficient clearness to enable us to determine this point. A plane, of the ordinary construction it seems, is to slide between cheeks, or guides; a crank, with a pitman, or shackle bar, being employed to give it motion. It is intended to plane up short stuff for boxes, &c. There is a feed roller which is to move the pieces to be planed.

Saws of the circular kind, we are told, may be driven by the same machinery. The claim is to "the construction and application of machinery in cross cutting and planing boards for boxes and other purposes." The sawing apparatus is represented in a separate drawing, but is not described in such a way as to enable us to judge of what is intended to be claimed, as it consists of circular saws moved in the ordinary way, the frame work being so arranged as to adapt it to the purposes to which it is to be applied.

[TO BE CONTINUED.]

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the mode of constructing the Fancy Card used in Wool Carding Machines. Granted to PHINEAS L. KING, *of Sparta, and* ENOCH BLASDEL, *of Lawrenceburgh, Dearborn county, Indiana, October 14th,* 1830.

THE carding machine to which this improvement is applied, is constructed in every respect like those in common use. The improvement which we claim as our invention, is in the *Fancy Card* for cleaning the main cylinder and doffer. Instead of the usual fancy card, (which is of short wire,) the one we have invented and applied to use, is made of needles, or long, steel, pointed wire teeth, properly secured in leather, behind, by wire, or any other suitable substance.

Our fancy card, constructed of needles, or long, steel, pointed wire teeth, not only does the business of the common fancy card in a superior manner, but it cleans the main cylinder and doffer, without wearing the cards, like the common fancy card.

This improvement can be applied to all wool carding machines.

The *invention* here claimed, is that of making fancy cards, (as before described,) of needles, or long, steel, pointed wire teeth, or long teeth made of common wire properly secured, instead of the short toothed fancy cards, now in use.

PHINEAS L. KING.
ENOCH BLASDEL.

Specification of a patent for the making of Reaction Water Wheels entire, of one single piece of cast metal; and the mode of forming the pattern so as to accomplish this end. Granted to CALVIN WING, *Gardiner, Maine, October 22,* 1830.

To all whom it may concern, be it known, that I, Calvin Wing, have invented a water wheel, the two rims, or ends of which, with the *floats or buckets*, consist of one entire piece of cast iron, or other *metal;* and also a mode of casting the same, as well as other wheels intended to be moved by the reaction of water. The construction of the wheel invented by me, is fully described in an instrument of writing deposited in the patent office of the United States, for the purpose of obtaining a patent for the manner of constructing the same, and for the mode of applying it to various uses. And I do hereby declare that the following is a full and exact description of the manner in which the pattern of my said wheel is made and *moulded,* in order to its being cast in one entire piece.

I cause a flask to be made in three parts; the depth from the top to the bottom of the middle section of the flask being equal to the width of the floats, or buckets, between the rims, or ends of the wheel. In moulding the wheel, the pattern of one of its ends is placed upon the mould board, with its inner side downwards, that which *I* call its open end should be preferred; one of the exterior parts of the flask is then placed over it, and filled with sand in the usual way. It is then turned up and the centre part of the flask placed over it. The patterns of the floats are then properly arranged around the moulded end, the patterns being prepared with dowels, or pins for that purpose. When this part of the flask has been filled with the casting sand, the pattern forming the other end of the wheel is laid upon the floats, and moulded in the third part of the flask.

When the moulding has been thus completed, in withdrawing the pattern, the upper part of the flask is removed, the pattern taken out of it, and those of the floats also removed from the middle of the flask; the end of the flask is then replaced, and the whole mould reversed, when the end first moulded is taken out. On replacing the end flask, the whole is ready for receiving the metal.

As in my reaction wheel the whole force to which it is subjected is sustained by one of its heads, through the centre of which the shaft passes, whether the same be used vertically, or horizontally, it is necessary to give considerable strength to that head, or end. But were this done by making the pattern of such head of the required thickness, there would be great danger of the cracking of the metal from unequal contraction in cooling, I therefore cast a centre piece, or hub, separately from the wheel, and secure it thereto by suitable bolts or screws.

What I claim as my invention, is the making reaction wheels entire, of one single piece of cast metal, and also the forming the pattern of my reaction wheel, so that the floats and the two heads may be moulded in a flask divided into three sections, in the manner, or upon the principle hereinbefore described, by which the same, or other wheels intended to operate as reaction wheels, may be cast in one entire piece. CALVIN WING.

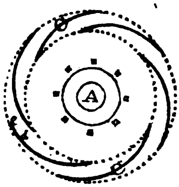
Specification of a patent for an improvement in the construction of the Water Wheel, and in its application to the driving of machinery, by the reaction of water. Granted to CALVIN WING, *Gardiner, Maine, October 22,* 1830.

To all whom it may concern, be it known, that I, Calvin Wing, have invented or discovered certain improvements in the construction of the water wheel for driving machinery by the reaction of water, and in the manner of applying the same, either to vertical or to horizontal shafts, and also in the application of water thereto, by which inventions or discoveries, the difficulties hitherto experienced in the construction of that kind of mill usually denominated Barker's mill, and the various modifications of the principle upon which it acts, which have been hitherto essayed, are so far obviated, as to render the same more economical and efficient than the ordinary modes of applying the power of water as a motive force. And I do hereby declare that the following is a full and exact description of my said improvements, reference being had to the drawings which accompany this specification.

The water wheel which I use is generally cast in one entire piece, in the manner described in a certain instrument of writing, deposited by me in the patent office of the United States, for the purpose of obtaining a patent for making the same of one entire piece, and for the manner in which this is effected. The wheel, however, may be made in separate parts, either of wrought or cast iron, or any other suitable material.

Fig. 1, is a bird's eye view of the wheel, the end to which the shaft is to be attached, at the perforation, A, being downwards, and the open end, or rim, upwards. To show the floats, the upper rim, which covers them, is not represented. The lines, C, C, ex-

Fig. 1.



hibit the form of the floats, or buckets, and the manner in which they are arranged. The diameter of this wheel, and the width of the floats between the two heads, and the depth of aperture between the floats, will, of course, be varied, according to the quantity and head of water which can be obtained, and the purpose to which it is to be applied. The curved floats, it will be seen, are made to lap over each other; and, in practice, I have found that the proportion in which they do so is a point of considerable importance. The proportion between the aperture and the lap which I have found to be the best, is as three to two; that is, for every inch of aperture, measuring from float to float, at the point where the water escapes, the floats should pass each other one and a half inch. It will be manifest that a slight deviation from this proportion, in either way, will not be attended by any sensible loss of power. I have found, however, that any considerable deviation is injurious. The mechanic should be careful so to construct his wheel that the part of the aperture seen at *c* should be less than that seen at *d*.

Upon the inner edge of the rim there is a projecting fillet, or flanch, which may be seen in the section D, of this wheel, at the lower part of Fig. 3, with this difference, that said fillets or flanches are to be made flat, as they are to work against, and not within, each other.

What I claim in the construction of the above described wheel, is the arrangement of the floats, or buckets, within the narrow rim forming the open head of the wheel, and their passing, or lapping over each other, in the manner described, by which the water is delivered tangentially from the wheel, or nearly so, whilst it is subjected to but little friction, or obstruction from other causes.

Wheels so constructed I apply either on a horizontal or vertical shaft, and either singly or in pairs, according to circumstances.

Fig. 2.

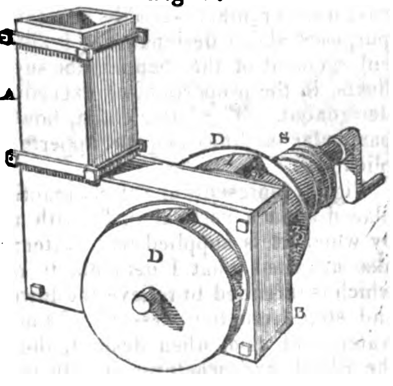


Fig. 2, represents the double reacting wheel, placed on a horizontal shaft, in which manner I use them whenever it is desirable to obtain motion from such a shaft. S, is the horizontal shaft, A, the penstock, and B, the cistern, the heads, or sides of the cistern, are formed in whole, or in part, of cast iron plates, securely bolted together. D, D, are two water wheels, one of which is placed on each side of the cistern, B, their open ends standing against the side plates of the cistern, which are perforated, having openings in them equal in size to those on the heads of the wheels, and being concentric with them. The fillet, or flanch, upon the rim of each wheel, is made flat, and is fitted to run as closely to a similar fillet or flanch on the cistern head as may be, without actually bearing against it, so as to prevent too much waste of water, and yet to avoid friction by touching it.

The size of the orifices in the wheel and cistern plates is a point of essential importance, and should greatly exceed what has been heretofore thought necessary. Their area should be such as to permit the whole column of water to act unobstructedly on the wheel, whatever may be the height of the head. I have found that for a head of four feet, the area of the orifice should never be permitted to fall short of three times the number of square inches which can be delivered by all the openings of the floats. The penstock, or gate way, should also be sufficiently large to admit freely the same proportionate quantity of water through every part of its section; say about three times the area of the orifices of the cistern heads and wheels.

For a greater head these openings must be proportionally increased, or the whole intention will be defeated, as it has been from want of attention to this principle, that numerous failures have occurred in the attempt to drive mills by reaction wheels. Whenever it is practicable, the limit which I have given should be exceeded, but never can be diminished without loss.

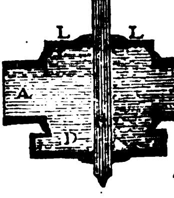
Instead of using a trunk, or penstock, smaller than the horizontal section of the cistern, B, I extend the sides, front, and back of said cistern, upwards in one continued line, whenever the same can be done; the cistern and penstock then form one trunk, of equal section throughout.

When greater power is requisite, I place other reacting wheels, or pairs of wheels, upon the same shaft, so that each may operate in the same way.

What I claim as new in the foregoing modification of my invention, as represented in Fig. 2, is the placing of two or more of my reaction wheels against reservoirs, or cisterns, formed of plates of cast iron, or other suitable substance, in the manner, and for the purposes above designated. I also claim as my improvement the enlargement of the channels for supplying water to the buckets or floats, in the proportion, or exceeding the proportion which I have designated. The latter claim, however, not being confined to this particular modification, but appertaining to my wheel, in all its applications.

Fig. 3, represents one of my reacting wheels, placed upon a vertical shaft, with the cistern by which it is supplied with water; to this is also attached what I denominate *the lighter*, which is intended to relieve the lower gudgeon and step, from the pressure of the column of water, and also, when desired, the weight of the wheel, and whatever is attached thereto. The whole being shown in a vertical section through the axis of the wheel.

Fig. 3.



A, A, is the cistern of water, the construction of which, with its penstock, may be seen at B, A, Fig. 4.

D, the wheel, the flanch on its upper side passing within the edge of that on the lower plate of the cistern.

L, L, the *lighter* for relieving the gudgeon and step of the shaft and wheel from the downward pressure.

The lighter is a circular plate of iron, concentric with the wheel, and attached to the same shaft. Upon its lower side is a flanch, or projecting rim, fitting into an orifice in the upper plate of the cistern, in the same manner in which that of the wheel fits into the lower plate; allowing, therefore, of a vertical motion of the shaft to a certain extent, without binding upon the plates of the cistern.

From the equable pressure of fluids in all directions, the lighter, (when equal in its area to that of the orifice of the wheel,) will be pressed upwards with the same degree of force with which the latter, (the wheel,) is pressed downwards; and if made larger, it will be pressed upwards with a greater force; and may be so proportioned as to take off the weight both of the machinery and of the water, from the gudgeon and its step.

When a single wheel is placed upon a horizontal shaft, the lighter will take the place of the second wheel, and so also in the case of any *odd number* of wheels, either on a vertical or a horizontal shaft.

What I claim of the foregoing, in addition to my former claims, is the application of the lighter for taking off the downward pressure when the wheel, or wheels, are placed on a vertical shaft; and for equalising the lateral pressure when placed upon a horizontal shaft.

Fig. 4.

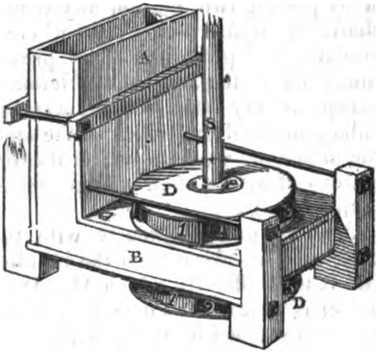


Fig. 4, represents the double reacting wheel on a vertical shaft. A, being the penstock. B, *the cistern.* D, D, the *wheels,* revolving within the plates of the cistern in the same manner as the wheel and lighter in Fig. 3.

The upper wheel in this arrangement answers all the purposes of the lighter in the former, the orifice of which may be enlarged, if desired, with the same views.

What I claim in this last modification of my invention, is, the placing of two or more wheels on a vertical shaft; the upper wheel of each pair operating as a lighter; but with the addition of a lighter should the series of wheels consist of an odd number. CALVIN WING.

Testimonials in favour of Mr. Wing's Water Wheel.

IT affords us pleasure to insert the following testimonials of the operation of Mr. Wing's water wheel. We have always thought the employment of the reaction wheel a very wasteful mode of applying water, as it had proved to be so in all the forms under which we have ever known it tried. Mr. Wing, however, bids fair to prove that, under the arrangements adopted by him, it will conquer all prejudices, and establish itself in the good opinion of the public, upon the basis of its real merits.

Many other testimonials have been exhibited to us, from persons worthy of all credit, both from their judgment and standing; but as they all tend to establish the same facts, we do not think it necessary to insert them.

Extract of a Letter from Alexander S. Chadwick, Esq. to the Editor. Dated Gardiner, Maine, July 24, 1830.

"In pursuance of your advice contained in your favour of the 21st May, Mr. Wing has proceeded farther in his experiments on the reacting wheel. He has put a double wheel in operation for propelling a saw mill, which, under every disadvantage attending all new experiments, gives the best satisfaction to all competent judges, and more than realizes his expectations. I do not hesitate to say, that *in all cases* of saw mills, he can save *one-half* of the water now required; in *general cases, two-thirds;* and, *in some instances, three-fourths.* There are a vast number of water rights which have been abandoned as valueless, to which the application of this wheel will give a power equal to the medium power of mill sites in the country generally.

Mr. W. has succeeded in doing away every objection heretofore existing to the reaction wheel. By the application of the *lighter*, or by placing two, four, or any *even* number of wheels upon the same shaft, (the *lighter* being used where an *odd* number is required,) he procures an equilibrium of the pressure of the column of water, and thus reduces the amount of friction occasioned by the water, which, except in very small wheels, was an insuperable difficulty. By the enlargement of the orifice of the upper wheel, or of the lighter, even the incumbency of the wheel itself may be supported by the water, instead of by the step. This last is only to be obtained from the vertical shaft.

Another great difficulty with the reaction wheel, was *want of power.* This arose from the injudicious construction of the wheel, and it is a difficulty which Mr. W. has wholly obviated. His first object is to leave the orifice so large that the column of water shall not be disturbed by that portion which is permitted to escape. Secondly, so to direct the water, as that its escape shall be as near as possible at right angles with a line drawn through the centre of the wheel; the power of reaction operating upon the wheel in a direct line with the escape of the water. This is not perfectly attainable in the construction of the wheel alone; but when it operates under water, its motion produces its own natural vacuum, the surrounding water forming a circular, elastic wall, and serves to assist in directing the water in a course rather *within a right angle* from the line drawn through the centre. This tends to throw the force of reaction rather *without the centre of the aperture extending, or lengthening, the natural lever of the wheel.* Hence, all the power which water is capable of giving is obtained.

The power of reaction always exceeds the power of percussion. This proposition will appear obvious from this elucidation; viz. the power of percussion can never exceed the whole amount of head and fall, lessened by all the friction of the aperture, through which the water escapes, and the atmosphere through which it passes. The power of reaction, rightly applied, is equal to all the head and fall, not decreased by the natural friction to be overcome in the passage of the water. In addition to this, in all other wheels, some part of the head and fall is necessarily lost. Here there is nothing lost.

My object in stating, so particularly, the merits of this wheel, is to prepare you, in some degree, to understand what Mr. W. claims as his improvement.

Abstract of Col. J. Conners' Certificate.

This may certify that I have carried on the lumber business in the town of Gardiner, for 29 years; have occupied the same saw mill with the old fashioned undershot water wheel. That I have now in operation one of Calvin Wing's improved reaction water wheels; have had an opportunity to test it thoroughly, and am satisfied that under the same head and fall it operates with equal power and speed, with less than one-half the water used by any other saw mill wheel that I have been acquainted with.

I have also used one of said Wing's reacting wheels in my clothing and carding mills, and I find by experience that the back water has no perceptible effect to retard the motion or lessen the power of the wheel, if the head is increased in the same ratio, and I give it as my opinion that said wheels are superior to any now in use.

JAMES CONNERS, Jr.

Gardiner, Maine, August 24, 1830.

George Shaw & Co.

This may certify that we have had in use a water wheel called a breast wheel, which drew on seventy-two square inches of water; that it failed to carry with sufficient speed the machinery which I had attached to it. I was induced to throw aside said wheel, and to put in its place one of Calvin Wing's double reacting water wheels, and I am satisfied that the same water will do more than double the work when used on said reacting wheel, that it would do on the breast wheel.

We have also a reacting wheel in use at our other works, and find it to answer the best purpose, and are of opinion that said wheels are preferable to any other wheels now in use.

GEORGE SHAW & CO.

Gardiner, August 25, 1830.

Specification of a patent for improvements in the apparatus for Boring the Earth for Water. Granted to Levi Disbrow, *City of New York, November* 2, 1830.

Mr. Disbrow has a former patent for boring apparatus. One particular object in the present patent, appears to be the employment of bits with springs attached to them, to cause them to bore a hole larger than that of the tube through which they are passed down. The parts described are as follows.

No. 1. *The pipes for sinking in the earth*, are of cast iron, of an equal bore throughout, but of a diminished thickness, taken from the outside near the end, till it is small enough to fit into the socket formed on the next length of pipe—the socket is formed by a band of wrought iron, placed on the end of the pipe, but which, when cold, contracts, and so remains permanent. The next length of pipe is formed in the same manner, and so may be continued to any required length or depth. The joints are closed as iron joints, by driving wedges, and so resist either water or steam.

No. 2. *The pod or cylinder bit for boring the earth*, passes through the pipe. It is made of iron, pointed with steel; there is a spring on the outside, whose most disengaged state is larger than the outside of the pipe, to the end that when it gets below the pipe, it may cause a hole to be bored larger than the pipe to be received; and which is effected by the distension caused by the spring.

No. 3. *The chain and levers for forcing down the pipe.* The levers are two pieces of joist made fast to the platform by pieces of chains, or other common means. The chains have hooks on either end. One hook fastens on the socket; the other is passed with the chain round the lever, and hooks in such part of the chain, as the purchase may require, at pleasure.

No. 4. *Rods connected by crutch joints and screws.* The rods are square lengths of iron; there is a square crutch formed at each end of the length, into which one admits the other. The ends are held by screws which pass each other transversely; by this means any length of rod may be securely connected, gaining the effect both of flexibility and strength.

No. 5. *The spring chisel* is formed by a spring which confines the operation of the chisel, or punch, to the edge of the pipe. Its use is for breaking off pieces of stone which in part obstruct the passage of the pipe.

No. 6. The rock boring tools are, first, a set of chisels, or punches; second, a riming bit. It is formed by four dies of steel well bolted on a square rod, which extends below as a guide; its use is to enlarge a hole already made to any proposed size. The whole of the above tools and apparatus are used with the machine already patented to said Levi Disbrow, dated twenty-fourth March, one thousand eight hundred and twenty-five. Levi Disbrow.

Observations on a patent obtained by Lieut. Bell, *for a Percussion Lock and Vent for Cannon; and an assertion of the original claim to that invention. By* Joshua Shaw.

Philadelphia, January 27, 1831.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—In the last December number, just received, is a notice of a patent granted to Lieut. W. H. Bell, for a percussion lock and vent for cannon. There never was a more striking instance of the natural propensity which one man has to disregard the rights of another, than is exhibited in the conduct of this gentleman, and in the use and application of the machine in question, which is not in any essential degree, or particular, different from one patented on the 24th day of October, 1828. You have observed that, excepting in the mere arrangement of the parts, *you do not think it new.* And again in speaking of the countersinking of the vent to receive the primer, which stands as conspicuously as any other part of the arrangement, you ask, *is this new.* Now it would extremely oblige one who is much interested in this matter, to be permitted to inquire if *there be any thing new* in this specification, or which did not originate with some other person, and which was not communicated to Lieut. Bell long previous to his application for a patent.

The author of these remarks was the first to discover the process of firing cannon by the means here employed, and the power of the fulminating matter to penetrate through the cavity of the vent, and to ignite the charge without the assistance of the priming wire, priming materials, or other priming powder, by the means of a machine acting upon it in precisely the same manner as in Lieut. Bell's apparatus, which is the same in principle with mine, without a single advantage being gained; except it be contended that the contracting of the vent, and the placing it on one side, constitute any; and if such be the case, the claim should be exclusively confined to them. However, it is doubtful if the first could be sustained, as a vent is only such, and has been drilled of every dimension, without any fixed rule. With respect to its location on the side, it is a very important point gained, where a lock of any kind is employed, whether it be on the percussion or the flint lock principle. But it is believed that Lieut. Bell never intended to claim these as his invention; they are, however, introduced, and that in a way very well calculated to serve a lame purpose, by qualifying a machine otherwise useless, as it would be impossible to apply it to the guns now in the United States' service. To have been consistent, this specification ought to have gone further, and have laid claim to the cannon also, since, if a mere change in the *arrangement* of the parts of a machine will suffice in the first case, it must apply with equal *certainty* in the second instance.

On first reading the account of Lieut. Bell's patent, I confess that I felt my indignation rising, and was disposed to be very angry; but my charity for human failings has prevailed over the less kindly feelings of our nature, and has induced me to conclude that the Lieutenant did not comprehend the law on patents, and acted under the impression that the right of invention was a sort of debateable property, a something like waste lands, on which any person who felt disposed, might locate himself without asking any questions, break up the soil, and work it for his own purposes and benefit. If this be not the view taken of it by the gentleman, it will be impossible to account for his conduct in any other way, especially when the following particulars shall be made known. In 1828, or 1829, Lieut. Bell called on the subscriber for the purpose, as he said, of making inquiries respecting the various modes of preparing and applying the fulminating powders to the best advantage, as a priming for cannon. I communicated all that I knew, freely and unreservedly, and pointed out to him the various advantages and disadvantages attending its application, observing that the vents as now made were in general too large to apply it advantageously; that the reaction upon the cock at the moment of discharge was one of the principal objections, as it required the addition of a safety spring. This difficulty, I observed to him, could be easily removed, when new castings should be required, by merely drilling the vents of about half their present diameter, and that a further advantage could then be secured by making it on the side, which would free the sight. I then exhibited to Lieut. Bell one mode of doing this, not by mere explanation, but I produced and exhibited to him a working model complete, and which he examined carefully, and with manifest interest. He said it was excellent, and one of the most valuable improvements he had heard of. He expressed his surprise that I should be so ready to show it, and said that it could be taken advantage of to my prejudice. I told him that I did not think so, as I believed my specification covered the *principle*, and that with respect to the mere *arrangement* of the parts, the same thing could be done in many different ways; that the numerous guns in the American service were very differently formed at the breech, and required the *arrangements* to be varied accordingly, so as to render the invention applicable to them, and useful to the government; that so long as the principle was the same, any mere variation of form would be an invasion of my patent, especially where the change, or variation, was the consequence of necessity or convenience. He, perhaps, thought otherwise. I had also in my possession at the same time, a lock mounted on a skeleton cannon, with the vent contracted; and placed on the side of the vent field; this, if my recollection serves me, was standing in the room at the time; of this, however, I will not be certain, but it is certain that I described it, and some other modes, which I had reduced to practice. Of these facts, and the conversation which passed at the time, I have the most unimpeachable evidence.

Now as these observations involve something more than a mere statement of isolated facts, your attention to them by an insertion in the Journal of the Franklin Institute, will oblige one, at least, who has benefitted his country by the introduction of a valuable discovery, t a contrivance,) through years of expensive experimental labour, t whose lot it may be, like many others, to be deprived of his just ward. It is, however, to be hoped, that the time has come, when simple change in the *arrangement* of the parts of a valuable instrument, will *not* entitle the speculator to a preference, and leave the original inventor destitute.

I am, sir, very respectfully,
your obedient servant,
Joshua Shaw,
Christian street, Philadelphia.

On Mr. M. Smith's *improvement in Compass Needles.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

City of Washington, February 10*th,* 1831.

Sir,—In the remarks which you appended to the specification of my patent for an improvement on surveyors' and mariners' compass needles, published in your last volume, p. 238, allow me to say that the remarks which you make on the theory upon which I have proceeded, are liable, and likely to prejudice the minds of most of your readers against the needle itself, or the improvement which I believe that I have made in it. The greater number of persons are incapable of abstracting the theory from the fact, and are apt to think that if the former is impugned, the latter must fall with it. I really have not the arrogance to pretend to form a theory upon subjects where those who are greatly my superiors in learning are at a loss. I am a mere practical man; the earlier period of my life was spent in the service of my country, in the revolutionary war; and since that time, I have been much engaged in practical surveying. This first led me to pay particular attention to the compass needle, and to a desire to remove some of those difficulties which often baffle the surveyor and the mariner, and not unfrequently endanger the safety of the latter. I think I have now, in the eve of my life, something to offer to my country, which will be found to be a valuable practical improvement. Leaving, therefore, the discussion of the theories to others, and abandoning every thing in my specification which is merely theoretical, I will merely ask you to state to the public the facts which I have recently exhibited to you, as I think by so doing you may do an essential service to society, and perhaps benefit an humble individual.

If I have done something more than other mere practical men, it may be fairly attributed to a degree of persevering industry, which has always kept my eyes open to those facts which have come under their notice, and a disposition to endeavour to turn them to advantage.

That you are as much a friend to truth as I am, and that it is your wish to disseminate it, I am fully convinced. You will, therefore, I am sure, insert this letter in the next number of your Journal, with such other matter as you may think calculated to place my claims in their proper light.

Very respectfully, &c.

MOSES SMITH.

Remarks by the Editor.—After receiving the foregoing letter from Mr. Smith, we should think it not only unkind, but unjust, to say any thing further respecting the theory of what he calls his electric rods; and more particularly as we are convinced, from what we have ourselves seen, that Mr. Smith has actually made one important discovery as regards the magnetic needle. It is well known that from the firing of cannon, and violent concussions of other kinds, the magnetism of the compass needle, becomes deranged, or confused, in which state it will be generally found to have several, instead of only two poles; and its directive power is consequently destroyed. In the experiments exhibited to us by Mr. Smith, he took a needle, the directive power of which was perfect; he struck it a moderate blow at each end, longitudinally, and it became deranged; on striking it transversely on each side of its centre, its power was instantaneously, and *perfectly* restored: this he repeated several times. He then placed it upon a table, held it firmly down, in the manner described in his specification, and by striking the table, produced effects analogous to those which resulted from striking the needle itself. This instantaneous mode of restoring the magnetic power, which was new to us, may, it is manifest, be of incalculable importance, particularly at sea, where the safety of all on board a vessel frequently depends upon the good order of the compass needle. Mr. Smith avers, that in all cases of accidental disturbance of the magnetic power, his method is effectual, and he appeared to be borne out by his experiments. With respect to what he calls his feeders, he believes himself justified by long continued observation, in concluding that they protect the needle from foreign attractions, and increase its directive power. They are now in a fair way of being tested, as there are some of them on board of our ships of war. Mr. Hasler, whose judgment in such cases is well known to every man of science, is very favourably impressed with regard to their operation, and has given a testimonial to that effect; and several other gentlemen conversant with this subject, anticipate much advantage from Mr. Smith's inquiries.

FRANKLIN INSTITUTE.

Monthly Meeting.

THE stated monthly meeting of the Institute was held at their Hall on Thursday evening, January 27, 1831.

Mr. ISAAC B. GARRIGUES, was appointed chairman.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Mr. A. B. Hutton.

Historical and Descriptive Anecdotes of the Steam Engine, and of their inventors and improvers, by Robert Stuart.

By Mr. John Ronaldson.

Elements of Natural Philosophy, by John Leslie, Esq. Vol. 1. (*including Mechanics and Hydrostatics.*)

By the Board of Managers of the Institute, for 1830.

Observations sur la Physique, sur l'Histoire Naturelle et sur les Arts, Vol. 1 *to* 27, *and* 32 *to* 40.

By C. C. Biddle, Esq.

A series of the National Gazette and Literary Register, from November, 1820, *to June* 30, 1830.

By Mr. A. Ramage.

A medal issued on the opening of the Liverpool and Manchester Rail-road.

By James Dundas, Esq.

A medal issued on the proclamation of William IV. king of Great Britain.

By Mr. James Harper.

The Report of the Managers of the Schuylkill Navigation Company, for 1830.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute, viz.

Journal of the Philadelphia College of Pharmacy, Nos. 1, 2, 3, *Vol.* 2.

The Mechanics' Magazine, and Journal of Public Internal Improvements, for December.

London Journal of Arts and Sciences, for November and December.

The Register of Arts and Journal of Patent Inventions, for November and December.

The Repertory of Patent Inventions, for November and December.

Professor A. D. Bache, from the committee on explosions of steam engines, reported that the committee were progressing in their preparations for the experiments, and expected to be engaged in trying them previous to the next meeting of the Institute.

Mr. D. H. Mason called the attention of the meeting to the subject of the method of applying the power of steam engines to locomotive carriages, when, on motion, it was resolved, that the subject be placed on the minutes for discussion at the next meeting.

On motion, it was resolved, that a committee be appointed, whose duty shall be to keep a meteorological register, which shall be published monthly in the Journal of the Institute.

Mr. Reuben Haines, Professor A. D. Bache, Messrs. W. Keating, W. R. Johnson, and James P. Espy, were appointed the committee.

Adjourned.

ISAAC B. GARRIGUES, *Chairman.*

JAMES H. BULKLEY, *Recording Secretary.*

Board of Managers.

A MEETING of the Board of Managers of the Franklin Institute, was held at the Hall of the Institute, January 24, 1831.

JAMES RONALDSON, president, in the chair.

The actuary read so much of the minutes of the annual meeting of the Institute, as related to the election of this Board, whereupon the Board went into an election for the officers of the Board for the ensuing year. Messrs. Samuel J. Robbins and Frederick Fraley, were appointed tellers, who having received the votes of the members, reported the result to the president, who declared the following gentlemen duly elected, viz.

M. D. LEWIS, *Chairman.*
SAMUEL J. ROBBINS, } *Curators.*
ISAAC HAYS, M. D. }

The president having retired from the chair, Mr. Lewis took his seat as chairman, when, on motion, it was resolved, that the bye laws which governed the former Board, be adopted for the government of this Board, until annulled.

Resolved, that the committees appointed by the former Board, to try experiments on water wheels, and to inquire into the cause of the explosion of the boilers of steam engines be continued.

An adjourned meeting of the Board of Managers, was held at the Hall of the Institute, January 27, 1831.

M. D. LEWIS, chairman.

The minutes of the last meeting were read and approved.

The chairman nominated the standing committees, in conformity to the regulations; which nomination, after adding Messrs. C. Gobrecht, James J. Rush, and W. R. Johnson to the committee on inventions, was approved by the Board as follows.

On Premiums and Exhibitions.

William H. Keating,
Samuel J. Robbins,
James Ronaldson,
M. W. Baldwin,
Frederick Fraley,
Joshua G. Harker,
Alexander Ferguson,
James H. Bulkley.

On Inventions.

Samuel V. Merrick,
Benjamin Reeves,
Alexander D. Bache,
Isaiah Lukens,
William H. Keating,
M. W. Baldwin,
Rufus Tyler,
John Agnew,
Mark Richards,
Christian Gobrecht,
James J. Rush,
W. R. Johnson.

On Publications.

Samuel V. Merrick,
Isaac Hays, M. D.
Alexander D. Bache,
Isaiah Lukens,
M. W. Baldwin.

On Instruction.

Alexander D. Bache,
M. W. Baldwin,
Abraham Miller,
John Wiegand,
Charles H. White.

On the Cabinet of Models.

Rufus Tyler,
John Struthers,
John O'Neill,
Joseph H. Schreiner,
Thomas Scattergood.

On the Cabinet of Minerals.

Abraham Miller,
William H. Keating,
Isaiah Lukens,
Adam Ramage,
Thomas U. Walter.

On the Library.

Isaac Hays, M. D.
Samuel J. Robbins,
Frederick Fraley,
Thomas Scattergood,
Charles Toppan.

Managers of the Sinking Fund.

Samuel J. Robbins,
Samuel V. Merrick,
Frederick Fraley,
M. W. Baldwin.

Auditors.

Abraham Miller,
Isaac B. Garrigues.

The candidates proposed at the last meeting, were duly elected members of the Institute.

Several candidates for membership were proposed, and laid over till the next meeting, in conformity to the regulations.

Extract from the minutes.

Mordecai D. Lewis, *Chairman.*

W. Hamilton, *Actuary.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on the Involute.

The curve called the involute may be formed by having a thread of any length, attached in the circumference of a circle, and stretched in a tangent to the circle, as *a*, 1, in the diagram, with a marking point at 1, which marking point is brought down to *m*, the thread being kept stretched, and winding round, and against the circle.

In a communication to this Journal, of March, 1829, on another subject, I incidentally noticed the use of this curve to express centrifugal forces. I will repeat in substance, what I then remarked, and give further examples of the practical utility of this neglected order of curves. Let the circle in the figure be the orbit of a body are not materially affected, because the motion by gravity and the centrifugal force generated by the motion, both decrease in the same ratio.

Before closing this paper, I will add another example, embracing more points of investigation.

A double pendulum, or governor, such as is used to the steam engine, is revolving, as I ascertain by my watch, 40 times in a minute; the arms are centred in the vertical axis. I also observe, by a graduated arc, affixed to the stern, that the arms revolve at an angle of 34 degrees with the vertical axis. It is required to know the centrifugal force, as compared with gravity, the diameter of the circle in which the balls revolve, and the length of the arms from the point of suspension to the centre of the ball, (or of gyration.)

Solution.—The centrifugal force will be to gravity as sine to cosine of the angle of inclination, from the vertical axis, which determined in the usual way, is in this case as 2 to 3.

The balls revolve once in 1½ seconds. Gravity is equal to a space of 434.25 inches in 1½ seconds. Then I consider the involute generated on the circle as equal to said 434.25 inches, which taken as a circumference, gives 138.226 inches for a diameter, which is the circumference of a circle, where the centrifugal force would be equal to gravity; but the angle of the arms show the centrifugal force equal to only ⅔ds of gravity, and as the centrifugal force, with the same number of revolutions, is as the size of the circle *directly*. The required circumference will be ⅔ds of said 138.226 inches, or 92.15 inches. The diameter required 29.333 inches, and radius 14.667 inches.

The length of the arm will be the hypotenuse of the right angled triangle, whereof the radius, or 14.667 inches is the base, (also sine,) and 22 inches the height, (or cosine,) and is found by the ordinary method to be 26½ inches, (very nearly.)

Then the answer will be as follows. The centrifugal force is equal to ⅔ds gravity. The diameter of the circle is 29⅓ inches. The length of the arm is 26½ inches.

Those who have leisure and inclination for mathematical research, will find an interesting, and somewhat novel field of action presented by the involute, which curve deserves to be rescued from its present obscurity, and placed on a level with the favoured few, created from conic sections.

THOMAS BAKEWELL.

Cincinnati, December 10th, 1830.

An inquiry into the causes of the ready Souring of American Flour, and of some other faults resulting from the mode in which it is manufactured. With suggestions on the proper means of remedying these defects.

THE following communication was received from a citizen of Philadelphia, whilst on a tour in the western states. He has had some experience on the subject upon which he writes, and we think that he has indicated the main source of the evil in question. Perhaps better plans may be devised for effecting the end proposed, but the *principle* is undoubtedly correct. [EDITOR.

Louisville, Kentucky, October 26, 1830.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—Although a number of years have elapsed since it was my business to be connected with the manufacturing of wheat flour, and the bread, hard or soft, made from it; still the circumstances of flour manufactured in Richmond, Va. having acquired so *respectable* a character, both at home and abroad, while that of Pennsylvania has hardly maintained its ground, and that made in this western, or rather in this interior quarter, is remarked for not keeping well, have all concurred to recall to my mind former observations, and to elicit new ideas. Of the many manufactures carried on in the United States, the making of flour is amongst the most important. It may therefore be fairly presumed that any thing having a tendency to improve this business, in however small a degree, will be acceptable to the patrons of the Journal of the Franklin Institute, which is devoted to the improvement and extension of the useful arts, and the promotion of the industry and resources of the union.

It will be found that a mixture of different wheats, that is, red, white, bearded, and common, supposing them all of good quality, and equally well manufactured into flour, will make better bread than any one of them simply. On the miller's experience and judgment depend the best proportions of this mixture, equal quantities not being that which answers best; and as it is not at all times in the miller's power, from want of the various kinds, to preserve this proportion, his skill is called upon so to proportion what he has, as to bring out the best results.

In the next place, it is a bad system to make flour entirely out of the new crop, immediately after harvest; such flour will not keep long, and it is not profitable for the baker; it will neither produce so much bread, or bread of so good a quality as a mixture of the old with the new. Suppose, for the sake of example, that for two months after the crop of any one year comes in, it is mixed with an equal portion of the crop of the preceding year, gradually diminishing the proportion of old wheat as the season advances; flour made of this composition of new and old wheat, is certain of keeping well, will make good bread, and more of it in proportion than flour used in the same quantity but made entirely of new wheat; here too the skill of the miller governs the result.

There have been, during the last twenty-five or thirty years, many improvements in the making of wheat flour, invented and introduced into this country. I believe that we are actually, if not technically, indebted to Oliver Evans, for the "Hopper Boy," the "Elevator," and many other improvements. To lessen the expense attendant on the management of the mill, by cooling of ground wheat rapidly, has been a primary object. But when the rapidity with which wheat passes through all its processes, and is packed into the flour barrel, is too great, it is very evident that it has not sufficient time to *cool* perfectly, and to *part with its moisture;* and it is probable this is a main cause why our flour does not keep long. It is a well known fact, that from some defect in the manufacturing, a large portion of our flour soon sours, grows hard, or otherwise spoils. This is a result most injurious to the country, and one which operates very disadvantageously on the miller, the merchant, the baker, the consumer, and the general character of the article in foreign countries.

The following new mode of managing the flour is suggested to remedy the evils just spoken of; and the writer of this is confident that all the good effects proposed, will result from the practice recommended; indeed every miller will at once see the connexion between the causes assigned, and the effect produced.

When the ground wheat issues from the mill stone, it is then quite warm, from the friction of the stones; that heat causes the latent damp that exists in wheat most sensibly to develope itself. To give the meal the greatest dryness, is to communicate to it the property of keeping long, and of readily and perfectly separating from the bran; the best mode of obtaining this dryness is now our object of inquiry.

To accomplish this all important object, it is recommended to the millers to fix an active wind fan, (fan mill,) so as to blow plenty of cool and fresh air among the warm meal just as it issues from the spout of the mill stones. This stream of air would not only cool the meal, but carry off the damp that at that moment is in its greatest state of volatility, in consequence of the heat. The stream of air would go off loaded with this vapour, but still there would remain heat, and consequently expanded moisture; a stream of air from a pair of bellows might, in addition to the former plan, be carried by a hose, and blown into the elevator; and lastly, the meal, when passing from the buckets of the elevator, might be subjected to the action of a second fan.

All this would so operate on the meal, that by the time it was converted into flour, both heat and moisture would be effectually removed; and there is every reason to conclude that flour made after this manner would keep long, and the meal would also be cool and dry when it arrived at the bolting process; it would most readily be separated into flour and bran, yielding a greater quantity of flour than by the present process.

A miller to become perfectly acquainted with the mixtures of wheat that produces the best bread, should have trials made by an intelligent, careful, and good baker. To become a good miller, this is almost essential. It is well known that when wheat flour has been ground very fine, no matter how good the quality of the wheat, and how well soever the flour may appear to the eye, the baker cannot make good bread with it. The appearance of such bread is wettish and doughy, much as when the wheat has been injured by rain in harvest time. Good judges will always prefer the flour that feels hardish, when rubbed between the finger and thumb, as if it were fine sand, and reject that which compresses and is smooth.

Very little has hitherto been written upon the making of flour, every one acting on the knowledge he has acquired from his own experience, and with him ends all the knowledge he has acquired, with the exception of what he communicates to those immediately connected with him.

Should you think what is now communicated to you in this paper likely to do good, or to induce those of more experience to digest their ideas and observations on this subject, and give them to the public, you will publish it, as then some advantage will result from this unpretending effort to benefit the community.

Although it is well known that flour frequently sours in a short time, and occasions great loss to the merchant; and the dealers in this article, find to their cost, that the western flour is specially faulty in this respect; this is not asserted of all western flour, but only of the larger portion of what passes down the Ohio. A close inquiry into the practice of the western millers, will prove that too little attention is paid to mixing wheats, and to the using of old with new wheat. The mills are small compared with the quantities of flour they produce, and consequently it is too much hurried to have time to cool. Some of the steam mills are so constructed that the whole air in the house is loaded by the steam with more vapour than the air can hold in solution; a large portion of this is thrown into the meal, so that in such places it is certain a bad keeping flour must be made.

Yours, &c.

J. R.

On Gunpowders and Detonating Matches. By Andrew Ure, M. D. F. R. S. &c.

Gunpowder is a mechanical combination of nitre, sulphur, and charcoal; deriving the intensity of its explosiveness from the purity of its constituents, the proportion in which they are mixed, and the intimacy of the admixture.

1. *On the Nitre.*

Nitre may be readily purified, by solution in water and crystallization, from the muddy particles and foreign salts with which it is usually contaminated. In a saturated aqueous solution of nitre, boiling hot, the temperature is 340° Fahrenheit; and the relation of the salt to its solvent is in weight as three to one, by my experiments—not five to one, as MM. Bottée and Riffault have stated.* We must not, however, adopt the general language of chemists, and say that three parts of nitre are soluble in one of boiling water, since the liquid has a much higher heat and greater solvent power than this expression implies.

---

* Traité de l'Art de fabriquer la Poudre á Canon, p. 78.

Water at 60° dissolves only one-fourth of its weight of nitre; or, more exactly, this saturated solution contains 21 per cent. of salt. Its specific gravity is 1.1415; 100 parts in volume of the two constituents occupy now 97.91 parts. From these data we may perceive that little advantage could be gained in refining crude nitre, by making a boiling hot *saturated* solution of it; since, on cooling, the whole would concrete into a moist saline mass, consisting by weight of 2¾ parts of salt, mixed with 1 part of water holding ¼ of salt in solution, and in bulk of 1⅞ of salt, with about 1 of liquid: for the specific gravity of nitre is 2.005, or very nearly the double of water. It is better, therefore, to use equal weights of saltpetre and water in making the boiling hot solution. When the filtered liquid is allowed to cool slowly, somewhat less than three-fourths of the nitre will separate in regular crystals; while the foreign salts that were present will remain with fully one-fourth of nitre in the mother liquor. On redissolving these crystals with heat, in about two-thirds of their weight of water, a solution will result, from which crystalline nitre, fit for every purpose, will concrete on cooling.

As the principal saline impurity of saltpetre is muriate of soda, (a substance scarcely more soluble in hot than in cold water,) a ready mode thence arises of separating that salt from the nitre in mother waters that contain them in nearly equal proportion. Place an iron ladle or basin, perforated with small holes, on the bottom of the boiler in which the solution is concentrating. The muriate, as it separates by the evaporation of the water, will fall down and fill the basin, and may be removed from time to time. When small nitrous needles begin to appear, the solution must be run off into the crystallizing cooler, in which moderately pure nitre will be obtained, to be refined by another similar operation.

At the Waltham Abbey gunpowder works, the nitre is rendered so pure by successive solutions and crystallizations, that it causes no opalescence in a solution of nitrate of silver. Such crystals are dried, fused in an iron pot at a temperature of from 500° to 600° Fahrenheit, and cast into moulds. The cakes are preserved in casks.

About the period of 1794 and 1795, under the pressure of the first wars of their revolution, the French chemists employed by the government contrived an expeditious, economical, and sufficiently effective mode of purifying their nitre. It must be observed that this salt, as brought to the gunpowder works in France, is in general a much cruder article than that imported into this country from India. It is extracted from the nitrous salts contained in the mortar rubbish of old buildings, especially those of the lowest and filthiest descriptions. By their former methods the French could not refine their nitre in less time than eight or ten days; and the salt was obtained in great lumps, very difficult to dry and divide: whereas the new process was so easy and so quick, that in less than twenty-four hours, at one period of pressure, the crude saltpetre was converted into a pure salt, brought to perfect dryness, and in such a state of extreme division, as to supersede the operations of grinding and sifting, whence also considerable waste was avoided.

The following is a brief outline of this method, with certain improvements, as now practised in the establishment of the *Administration des poudres et salpêtres*, in France.

The refining boiler is charged over night with 600 kilogrammes of water, and 1200 kilogrammes of saltpetre, as delivered by the *salpêtriers*. No more fire is applied than is adequate to effect the solution of this first charge of saltpetre. It may here be observed, that such an article contains several deliquescent salts, and is much more soluble than pure nitre. On the morrow morning the fire is increased, and the boiler is charged at different intervals with fresh doses of saltpetre, till the whole amounts to 3000 kilogrammes. During these additions, care is taken to stir the liquid very diligently, and to skim off the froth as it rises. When it has been for some time in ebullition, and when it may be presumed that the solution of the nitrous salts is effected, the muriate of soda is scooped out from the bottom of the boiler, and certain affusions or inspersions of cold water are made into the pot, to quicken the precipitation of that portion which the boiling motion may have kept afloat. When no more is found to fall, one kilogramme of Flanders glue, dissolved in a sufficient quantity of hot water, is poured into the boiler; the mixture is thoroughly worked together, the froth being skimmed off, with several successive inspersions of cold water, till 400 additional kilogrammes have been introduced, constituting altogether 1000 kilogrammes.

When the refining liquor affords no more froth, and is grown perfectly clear, all manipulation must cease. The fire is withdrawn, with the exception of a mere kindling, so as to maintain the temperature till the next morning at about 88° C. = 190.4° Fahrenheit.

This liquid is now transferred by hand-basins into the crystallizing reservoirs, taking care to disturb the solution as little as possible, and to leave untouched the impure matter at the bottom. The contents of the long crystallizing cisterns are stirred backwards and forwards with wooden paddles, in order to quicken the cooling, and the consequent precipitation of the nitre in minute crystals, which is raked, as soon as it falls, to the upper ends of the doubly inclined bottom of the crystallizer. It is thence removed to the washing chests or boxes. By the incessant agitation of the liquor, no large crystals of nitre can possibly form. When the temperature has fallen to within 7° or 8° Fahrenheit of the apartment, that is, after seven or eight hours, all the saltpetre that it can yield will have been obtained. By means of the double slope given to the crystallizer, the supernatant liquid is collected in the middle of the breadth, and may be easily laded out.

The saltpetre is shovelled out of the crystallizer into the washing chests, and heaped up in them so as to stand about six or seven inches above their upper edges, in order to compensate for the subsidence which it must experience in the washing process. Each of these chests being thus filled, and their bottom holes being closed with plugs, the salt is besprinkled from the rose of a watering can with successive quantities of water saturated with saltpetre, and also with pure water, till the liquor, when allowed to run off, indicates by the hydrometer a saturated solution. The water of each sprinkling ought to remain on the salt for two or three hours; and then it may be suffered to drain off through the plug holes below for about an hour.

All the liquor of drainage from the first watering, as well as a portion of the second, is set aside, as being considerably loaded with the foreign salts of the nitre, in order to be evaporated in the sequel with the mother waters. The last portions are preserved, because they contain almost nothing but nitre, and may, therefore serve to wash another dose of that salt. It has been proved by experience, that the quantity of water employed in washing need never exceed thirty-six sprinkles in the whole, consisting of three waterings, of which the first two consist of fifteen, and the last of six pots; or, in other words, of fifteen sprinklings of water saturated with saltpetre, and twenty-one of pure water.

The saltpetre, after remaining five or six days in the washing chests, is transported into the drying reservoirs, heated by the flue of the nearest boiler; here it is stirred up from time to time with wooden shovels, to prevent its adhering to the bottom, or running into lumps, as well as to quicken the drying process. In the course of about four hours, it gets completely dry, in which state it no longer sticks to the shovel, and falls down into a soft powder by pressure in the hand. It is perfectly white and pulverulent. It is now passed through a brass sieve, to separate any small lumps or foreign particles accidentally present, and is then packed up in bags or barrels. Even in the shortest winter days, the drying basin may be twice charged, so as to dry 700 or 800 kilogrammes. By this operation, the nett produce of 3000 kilogrammes thus refined, amounts to from 1750 to 1800 kilogrammes of very pure nitre, quite ready for the manufacture of gunpowder.

The mother waters are next concentrated; but into their management it is needless to enter in this memoir.

On reviewing the above process as practised at present, it is obvious that, to meet the revolutionary crisis, its conductors must have shortened it greatly, and have been content with a brief period of drainage.

2. *On the Sulphur.*

The sulphur now imported into this country, from the volcanic districts of Sicily and Italy, for our manufactories of sulphuric acid, is much purer than the sulphur obtained by artificial heat from any variety of pyrites, and may, therefore, by simple processes, be rendered a fit constituent of the best gunpowder. As it is not my purpose here to repeat what may be found in common chemical compilations, I shall say nothing of the sublimation of sulphur; a process, moreover, much too wasteful for the gunpowder maker.

Sulphur may be most easily analyzed, even by the manufacturer himself; for I find it to be soluble in one-tenth of its weight of boiling oil of turpentine, at 316° Fahrenheit, forming a solution which remains clear at 180°. As it cools to the atmospheric temperature, beautiful crystalline needles form, which may be washed sufficiently with cold alcohol, or even tepid water. The usual impurities of the sulphur, which are carbonate and sulphate of zinc, oxide and sulphuret of iron, sulphuret of arsenic and silica, will remain unaffected by the volatile oil; and may be separately eliminated by the curious, though such separation is of little practical importance.

Two modes of refining sulphur for the gunpowder works have been employed; the first is by fusion, the second by distillation. Since this combustible solid becomes as limpid as water at the temperature of about 230° Fahrenheit, a ready mode offers of removing at once its denser and lighter impurities, by subsidence and skimming. But I may take the liberty of observing that the French melting pot, as described in the elaborate work of MM. Bottée and Riffault, is singularly awkward, for the fire is kindled right under it, and plays on its bottom. Now a pot for subsidence ought to be *cold-set;* that is, should have its bottom part imbedded in clay or mortar for four or six inches up the side, and be exposed to the circulating flame of the fire only round its middle zone. This arrangement is adopted in many of our great chemical works, and is found to be very advantageous. With such a boiler, judiciously heated, I believe that crude sulphur might be made remarkably pure; whereas, by directing the heat against the bottom of the vessel, the crudities are tossed up and incorporated with the mass.

The sulphur of commerce occurs in three prevailing colours; lemon yellow verging on green, dark yellow, and brown yellow. As these different shades result from the different degrees of heat to which it has been exposed in its original extraction on the great scale, we may thereby judge to what point it may still be heated anew in the refinery melting. Whatever be the actual shade of the crude article, the art of the refiner consists in regulating the heat, so that after the operation it may possess a brilliant yellow hue, inclining somewhat to green.

In seeking to accomplish this purpose, the sulphur should first be sorted according to its shades; and if a greenish variety is to be purified, since this kind has been but little heated in its extraction, the fusion may be urged pretty smartly, or the fire may be kept up till every thing is melted but the uppermost layer.

Sulphur of a strong yellow tinge cannot bear so great a heat, and therefore the fire must be withdrawn whenever three-fourths of the whole mass have been melted.

Brown coloured brimstone, having been already somewhat scorched, should be heated as little as possible, and the fire may be removed as soon as one-half of the mass is fused.

Instead of melting, separately, sulphurs of different shades, we would obtain a better result, by first filling up the pot to half its capacity, with the greenish coloured, putting over this layer, one quarter volume of the deep yellow, and filling it to the brim with the brown coloured. The fire must be extinguished as soon as the yellow is fused. The pot must then be closely covered for some time; after which the lighter impurities will be found on the surface in a black froth, which is skimmed off, and the heavier ones sink to the bottom. The sulphur itself must be left in the pot for ten or twelve hours, after which it is laded out into the crystallizing boxes or casks.

Distillation affords a more complete and very economical means of purifying sulphur, which was first introduced into the French gunpowder establishments, when their importation of the best Italian and Sicilian sulphur was obstructed by the British navy. Here the sulphur need not come over slowly in a rare vapour, and be deposited in a pulverulent form called flowers; for the only object of the refiner is to bring over the whole of the pure sulphur into his condensing chamber, and to leave all its crudities in the body of the still. Hence a strong fire is applied to elevate a denser mass of vapours, of a yellowish colour, which passing over into the condenser, are deposited in a liquid state on its bottom, whilst only a few lighter particles attach themselves to the upper and lateral surfaces. The refiner must, therefore, give to the heat in this operation, very considerable intensity; and at some height above the edge of the boiler, he should provide an inclined plane, which may let the first ebullition of the sulphur overflow in a safety recipient. The condensing chamber should be hot enough to maintain the distilled sulphur in a fluid state,—an object most readily procured by leading the pipes of several distilling pots into it; while the continuity of the operations is secured, by charging each of the stills alternately, or in succession. The heat of the recipient must be never so high as to bring the sulphur to a siropy consistence, whereby its colour is darkened.

In the *sublimation* of sulphur, a pot containing about four cwt. can be worked off only once in twenty-four hours, from the requisite moderation of its temperature, and the precaution of an inclined plane, which restores to it the accidental ebullitions. But by *distillation*, a pot containing full ten cwt. may complete one process in nine hours at most, with a very considerable saving of fuel. In the former plan of procedure, an interval must elapse between the successive charges; but in the latter, the operation must be continuous to prevent the apparatus from being cooled: in sublimation, moreover, where communication of atmospheric air to the condensing chamber is indispensable, explosive combustions of the sulphurous vapours frequently occur, with a copious production of sulphurous acid, and correspondent waste of the sulphur; disadvantages from which the distillatory process is in a great measure exempt.

I shall here give an outline of the form and dimensions of the distilling apparatus employed at Marseilles in purifying sulphur for the national gunpowder works, which was found adequate to supply the wants of Napoleon's great empire. This apparatus consists of only two still pots of cast iron, formed like the large end of an egg, each about three feet in diameter, two feet deep, and nearly half an inch thick at the bottom, but much thinner above, with a horizontal ledge four inches broad. A pot of good cast iron is capable of distilling 1000 pounds of sulphur before it is rendered unserviceable, by the action of the brimstone on its substance, aided by a strong red heat. The pot is covered in with a sloping roof of masonry, the upper end of which abuts on the masonry of the vaulted dome of condensation. A large door is formed in the masonry, in front of the mouth of the pot, through which it is charged and cleared out; and between the roof space over the pot, and the cavity of the vault, a large passage is opened. At the back of the pot a stone step is raised to prevent the sulphur boiling over into the condenser. The vault is about ten feet wide within, and fourteen feet from the bottom up to the middle of the dome, which is perforated, and carries a chimney about twelve feet high, and twelve inches diameter within.

As the dome is exposed to the expansive force of a strong heat, and to a very considerable pressure of gases and vapours, it must possess great solidity, and is therefore bound with iron straps. Between the still and the contiguous wall of the condensing chamber, a space must be left for the circulation of air, a precaution found indispensable by experience; for the contact of the furnaces produces on the wall of the chamber such a heat as to make it crack and form crevices for the liquid sulphur to escape. The sides of the chamber are constructed of solid masonry, forty inches thick, surmounted by a *brick dome*, covered with a layer of stones. The floor is paved *with tiles*, and the walls are lined with them up to the springing of *the dome*; a square hole being left in one side, furnished with a strong iron door, at which the liquid sulphur is drawn off at proper intervals. In the roof of the vault are two valve holes, covered with light plates of sheet iron, which turn freely on hinges at one end, so as to give way readily to any sudden expansion from within, and thus prevent dangerous explosions.

As the chamber is an oblong square, terminating upwards in an *oblong vault*, it consists of a parallelopiped below, and a semi-cylinder above, having the following dimensions:—

Length of the parallelopiped, - -	16½ feet.
Width, - - - - - -	10⅘.
Height, - - - - - -	7¼
Radius of the cylinder, - - - -	5⅖
Height or length of semi-cylinder, -	16½

Whenever the workman has introduced into each pot its charge of ten or twelve hundred weight of crude sulphur, he closes the charging doors carefully with their iron plates and cross bars, and lutes them tight with loam. He then kindles his fires, and makes the sulphur boil. One of his first duties, (and the least neglect in its discharge, may occasion serious accidents,) is to inspect the roof-valves, and to clean them, so that they may play freely before any expulsive force from within. By means of a cord and chain, connected with a crank attached to the valves, he can, from time to time, ascertain their state, without mounting on the roof. It is found proper to work one of the pots a certain time before fire is applied to the other. The more steadily vapours of sulphur are seen to issue from *the valves*, the less atmospherical air can exist in the chamber, and therefore the less danger there is of combustion. But if the air be cold, with a sharp north wind, and if no vapours be escaping, the operator should stand on his guard, for in such circumstances a serious explosion may ensue.

As soon as both the boilers are in full work, the air is expelled, the fumes cease, and every hazard is at an end. He should bend his whole attention to cut off all communication with the atmosphere, securing simply the mobility of the valves, and a steady vigour of distillation. The conclusion of the process is ascertained by introducing his sounding rod into the pot, through a small orifice made for its passage in the wall. A new charge must now be given.

By the above process, well conducted, sulphurs are brought to the most perfect state of purity that the arts can require; while not above four parts in a hundred of the sulphur itself are consumed; the crude, incombustible residuum varying from five to eight parts, according to the nature of the raw material. But in subliming sulphur, the frequent combustions inseparable from this operation carry the loss of weight in flowers to about twenty per cent.

The process by fusion, performed at some of the public works in this country, does not afford a return at all comparable with that of the above French process, though a much better article is operated upon in England. After two meltings of *grough* sulphur, (as imported from Sicily or Italy,) eighty-four per cent. is the maximum amount obtained, the average being probably under eighty; while the product is certainly inferior in quality to that by distillation.

[*Journal of the Royal Institution.*

[TO BE CONTINUED.]

Account of the processes followed in Mexico, in the reduction of the Precious Metals. Extracted from a review of a work entitled "Commentaries on the Mining Ordinances of Spain;" contained in the Journal of the Royal Institution of Great Britain.

One object of the author of the above work, is to give as much instruction and useful information as he could collect, on the various subjects connected with mining and the reduction of the metallic ores; and particularly that which is of a nature to interest the practical miner and metallurgist, and to lead them to the attainment of greater perfection in their several departments.

Amongst the most interesting of the subjects discussed under this head, is that of the reduction of the ores of the precious metals; under which the author takes an opportunity to describe the processes employed for that purpose in Mexico, at the period when he wrote, and which are, with little or no variation, the same now practised in that country. The Mexicans are not so rude and unskilled in the art of reducing their ores, as they have been erroneously supposed in this country to be. The processes employed by them, although conducted with little scientific knowledge, and, generally speaking, with no other guide than long practice and experience in the pursuit, are found, from the nature of the ores, and the circumstances of climate and other local accidents, to be better adapted for that country than any others, as is sufficiently proved by the complete failure of Sonneschnied and his colleagues, in their attempt, under the auspices of Charles III., to introduce into America the improvements of Europe.*

The smelting process is described by the author as follows:—

"*Of preparing and mixing the ores, previous to their reduction by smelting. Of the construction of the various smelting furnaces employed.*—All the ore raised from the mines is carried to the reduction works, where a receipt is signed on the memorandum brought by the carrier from the mine. The workmen at the reduction works, taught by experience, distinguish the ores adapted for smelting, from those proper for amalgamation, according to their nature, and arrange them separately in an office or store room. The ore is pounded by beating with a pick or hammer, or more readily, and at less expense, in stamping mills; and being reduced to fragments of a greater or less size, according to its tractability or obstinacy under the action of the fire, it is piled in heaps, or spread out at once for the purpose of making the *revoltura* or *revolturon*, which is the mixing together of several ingredients, namely, the principal ore, the assistant ore,† litharge, impregnated cupels or bottoms of furnaces, *plomillos*,‡ *fierros*,§ and slag.

"In making this mixture, the nature of the ore is attended to; some ores requiring a mixture of all these ingredients, and others not. No general rule, however, can be given for these mixtures, but the miner must frame rules for his own government, founded on repeated experiments and long observation, making him familiar with the nature of the ore.

"The mixture, being prepared in the manner above described, is placed in the furnace to be smelted. There are many descriptions of furnaces; some being made of stone, some of mud bricks, and some of clay. In some the smelting is performed with wood, in others with charcoal; in some the mouths or apertures are stopped up, and in others left open. In some, the ore and wood are mingled together; in others, the wood or charcoal is not in contact with the ore, but the flame only, whence they are called *reverberatory* furnaces.

"*Of the smelting of ores.*—Having made the proper mixture, and prepared the furnaces and the machines for supplying them with wind, the smelter must heat or anneal the furnace, if, from being new or newly repaired, it requires it; for, if the ore be thrown in whilst the furnace is cold, it is apt, upon getting warm, to fly or crack, with danger to the bystanders: and if it be moist, in the summer, the same thing will happen, and it will explode with very great force. During the first few hours, charcoal is first thrown in, then a basket of slags, then one of charcoal, and so on, until it be time to add the mixed ore. Half a basketful of this is then thrown in, and upon that a basket of charcoal, and so on, until the furnace begins to work, after which, alternate basketsful of mixed ore and charcoal are thrown in. One or two *cargas* of charcoal are consumed for each charge, according to the nature of the ore; some ores requiring the furnace to be moderately filled; others, that it should be filled to the top. If the ore be not earthy, but clean, the furnace may be charged freely.

---

* See Sonneschnied's *Tratado de la Amalgamacion de Nueva Espana;* in the preface to which the author acknowledges his inability, after ten years labour, to introduce with effect, into Mexico, either the process of Baron Born, or any other, preferable to that of the *patio*, which, he says, in p. 91, of the work, "has subsisted two centuries and a half, and will subsist as long as the world endures."

† "Metal de Ayuda"—Ore of a more fusible character, mixed with the less tractable ores to assist their fusion.

‡ "Plomillos"—Scoriæ charged with *lead*.

§ "Fierros"—Slag or scum, being an unreduced mass of oxides and sulphurets, in which those of *iron* predominate.

"The furnace being thus arranged and brought into play, smelts four charges in twenty-four hours, the ingots being tapped off from time to time; for which purpose, an aperture is made below the bridge of the breast pan, and the melted portions run off into the float. The first ingot let off, after repairing the furnace, is called *calentadura*, and is smaller than the others, because the furnace becomes coated with vitrified ore adhering to it, and care is therefore taken not to throw in rich ores for the *calentadura*. The fused metal being let off, the bridge is stopped up, the breast pan is cleared out, charcoal dust is thrown into and around it, and the furnace is again set to work. The portions which may have adhered to it are taken off last of all, and are mixed with the ores in future smeltings.

"After the smelting is performed, the furnace is uncharged, which is done in the following manner. The charges of ore being all finished, slags and charcoal alone are thrown in, until all the smelted ore has flowed into the breast pan, when the furnace throws off a very beautiful flame. The wall of mud bricks, and every thing which may have adhered to it, are then broken down with a crow or iron bar of about twenty-five pounds weight. And here the unfortunate smelters suffer much, during an hour of great labour; for the furnace is hot in the extreme, the crow is heavy, and the incrusted matter adheres very closely. The smoke and vapour from the slag, which are quenched by pouring water upon them, and which are consequently carried down to the feet of the workmen, are poisonous; and as they drink water incessantly to relieve their exhaustion, they lose the use of their hands and feet, and become bloated. They are subject also to violent pains in the stomach, occasioned by the coldness of the ore."

After describing the mode of refining the silver, the author proceeds to describe the operation of cold amalgamation, or amalgamation by the *patio*, by which the greater part of the gold and silver now circulating over the whole globe has been reduced from the ore.

"*Of the reduction of ores by quicksilver.*—Nature, by exhibiting to mankind the effect of fire in fusing the surface of mountains, first suggested to them the idea of smelting the ores containing lead. Nature also, by setting before them the particles of quicksilver found amongst the ores, first guided them to the method of mixing the harsh ores with quicksilver, salt, and water; an operation which, although in the infancy of the discovery rude and troublesome in practice, requiring many months to effect the reduction of the gold and silver, has now, by the devices of art, and the lessons of experience, (the best instructer in the hidden mysteries of physics,) been carried to perfection; *magistral*[*] and various other mixtures being employed, so that the ore may be reduced in twenty days, or under—and the process has even been completed in twenty-four hours.

"The object of first importance, in the process of amalgamation, is to provide a skilful amalgamator, capable of distinguishing between smelting ores, and those adapted for amalgamation; who can make assays, in the small way, to ascertain what the *monton* will yield in gross; who understands the proper ingredients, temperatures, admixtures, and stirrings to be applied, and who can calculate and compare the probable amount of the expenses and of the metallic produce: for the bringing the silver to the proper point is not to be entrusted to a mere ignorant blockhead.

"Secondly, a due selection of the ores must be made for the purpose, in performing the reduction by amalgamation, of making such mixtures as their nature may require; and such ores as require *smelting*, must be set apart for that operation.

"Third, the ore must be ground as fine as possible, that the quicksilver may combine more readily with the silver.

"Fourth, the ore being ground, it is the practice, in some districts, to roast such as is of a sulphurous or bituminous (?) nature, in furnaces adapted for that purpose; in which the criterion of being sufficiently purified, is the ceasing to give off vapour. The same treatment is also applied to the pyritous or resplendent ores, which, under the influence of fire, lose their splendour, and at the same time, *get rid of their* prejudicial qualities. Those which contain litharge or copperas, should not be roasted, until they have been washed and thoroughly agitated in tubs of water, so as to separate the copperas; for unless this precaution be taken, it will be increased in quantity by the action of the fire, instead of being driven off, and it will have the effect of destroying the quicksilver, and preventing its uniting with the silver. It is sometimes proper to roast the ore after grinding, and sometimes while in the rough. But the most usual course, in the mining districts of New Spain, is not to roast the ore at all, on account of the injurious effect of the operation, in rendering it dry, in diminishing its richness, and in augmenting its bad qualities.

"Fifth, the ore being ground, is thrown into heaps or *montons*, usually of 30 quintals; but in some places of 18 quintals: and the *montons* are sometimes placed beneath a roof, but most frequently in a well flagged yard or *patio*, whence this mode of reduction is called the reduction by the *patio*.

"Sixth, with each *monton* of 18 quintals, are mixed two barrels of brine, from impure salt; six, eight, or ten pounds of *magistral*, as the nature of the ore may require, and from ten to twelve pounds of quicksilver. The *monton* thus prepared, is stirred and trodden, which is called *repasar*. After two or three days, the stirring and treading are repeated, and if it require more quicksilver, a further charge is thrown in, and it is again stirred, until found to require no more: and it is to be observed, that the more quicksilver it requires, the better, as a proportionate quantity of silver may be expected.

---

[*] Sulphuret of copper, roasted and ground to powder.—*Trans.*

"Seventh, the quicksilver must be added at different times, and not be thrown in all at once, so that it may by degrees take up the whole of the silver. The first stirrings must be performed with softness and gentleness, lest the quicksilver should become too minutely divided, and form *lis*, which is the term applied when it divides into almost imperceptible particles. From the varying nature of the ore, and the diversity of circumstances which arise, no certain rules can be laid down for the course to be pursued in stirring in the quicksilver and *magistral*, and it will therefore be found, that it is sometimes necessary to excite heat by stirring, and at others to apply moisture. Neither is it possible to determine the precise moment at which the *montons* are in a state for washing, for though they may not make any *lis* of silver, nor require any more quicksilver, yet the quicksilver may be dispersed. The only rule is, to ascertain whether the proportion of silver taken up, corresponds with the result of the assay made at the commencement of the process; and there is no way of ascertaining this, but by making a further trial, in a small way, whether the *monton* is in want of any addition, which in such case must be supplied, or whether it is complete, in which latter case the *monton* may be washed.

"Eighth, the *monton* being ready for washing, is thrown into wooden vats of very large size, within each of which is contained a mill. The mill is turned by a mule, and it is proper that it should not always go round in the same direction, but that the motion should be sometimes reversed: the object being, that the *lises* of silver may fall to the bottom, and that the quicksilver contained therein may not be lost by escaping with the slime or earthy residue, which contains a proportion of silver, and also of quicksilver in a minute state of division. To prevent this loss, it is therefore necessary that the mixture should be kept briskly stirred in every part. The slime being separated, the quicksilver remains at the bottom of the vat, combined with the silver, in which state it is called amalgam. The amalgam is taken out and placed in a linen bag, which being suspended from the beams, the uncombined quicksilver runs out. The part which remains in close combination is made up into small cakes, which are formed into one large cake or *piña*, (pine apple,) the size being adapted to the capacity of the brass cap or bell. The latter consists of two pieces, the first of which is in the form of a large basin, with a groove round the rim and a hole in the bottom. On the inner part of the rim are three rests, on which is placed a grating, made of iron bars, and upon that is set the *piña* or cake, which is covered over with the cap. The cap is bell shaped, and fits into the groove of the vessel, which must be surrounded with earth, and have a pan of water beneath it. The cap or bell remains above, and is covered entirely with ignited charcoal, the heat from which, raising the quicksilver in vapour, it finds its way into the vessel, and passing through the hole in the bottom, is received in the pan of water, and brought back into the state of fluid quicksilver. Where caps of brass, copper, or iron, cannot be procured, they must be made of the finest clay, adapted to resist the fire.

"The proportion of silver returned, depends on the quality of the ore; sometimes the produce of silver is equal to an eighth part of the quicksilver mixed in with the *monton*, sometimes a sixth part, and sometimes a fifth part. The quicksilver separated in a liquid state, still contains minute particles of silver, and it is set apart to be used in working other *montons*, until consumed. This is the only part really consumed;* for the rest is either lost by being converted into *lis* in the *montons*, or escapes with the slime, from the agitation of the mill, being divided into the most minute and imperceptible particles. A quintal of quicksilver is not wholly consumed until after it has been employed seventeen times."

When the ore is tolerably rich, and a more speedy return of the silver is desired, another process is sometimes resorted to, which is called the *beneficio par' cazo*, or reduction by the *cazo*. This process has the advantage of wasting very little quicksilver, and is thus described:—

"*Reduction by the cazo, (pan.)*—This method of reduction affords the most speedy means of extracting the silver. The ore being thoroughly ground, and a quintal being taken, the proper quantities of salt, water, and quicksilver, are mixed in, according to the nature of the ore. The mixture is then placed over the fire, and must be kept constantly stirred, and the act of ebullition further assists in keeping it in motion. It is tried from time to time, to ascertain whether it requires any further addition of quicksilver or salt. Each pan will reduce three charges per day. If the ore be rich it will often yield a marc, a marc and a half, or two marcs per quintal: and provided the quality be not lower than six ounces, this mode of reduction is very advantageous; but if the produce of silver be below that rate, it will not answer, from the great consumption of wood, quicksilver, and salt, together with the cost of the pans and coppers. The latter must be closely attended to, to see that there are no chinks or cracks in the bottom, through which the quicksilver might escape; to prevent which, they should be varnished with several coats of lime, slag, iron, and white of egg, well beaten up together. *Barba* expresses himself in highly approbatory terms of this method of reduction, both on account of the saving in quicksilver, explore these mines, with a master smith and master bricklayer, and having set up a shed, a house, a smithy and furnaces, he had a part of the crest of the vein blasted away on the 14th of October, and commenced the works of San Mateo, San Joseph, and Santa Catalina, all contiguous. He began three adits at a greater depth; but the hardness of the ground obliged him to remove half a league farther down, where, finding fair indications of success, he drove the work of la Concepciòn. Here also he found very good ore, in a matrix of white spar, and drove a work, which he called los Reyes. He then drove an adit in a cross direction, and, at the distance of 47 *varas*, cut a vein of considerable size. Several assays were made of the ores from these works, both in the large and small way. Those from San Mateo yielded, by the minute assay, 12 ounces of quicksilver per quintal, those from Concepcion 25 ounces, those from the cross cut 26 ounces.

---

* In Mexico, the difference between the quantity of quicksilver employed in the process of reduction and the quantity recovered, is arbitrarily divided into quicksilver *consumed* and quicksilver *lost*; a quantity equal or proportionate in weight to the silver obtained, being said to be *consumed*, and the remainder of the deficient quicksilver to be *lost*.—*Trans.*

"The second instance was during the viceroyalty of the Duke de la Conquista, who, in the year 1740, commissioned Don Philip Cayetano de Medina, an alderman of Mexico, and proprietor of the estate in which the Cerros of el Carro and el Picacho were situated, and Don Gregorio de Olloqui, an inhabitant of San Luis Potosi, to inspect some quicksilver mines in the aforesaid Cerros, which, according to Don Mathias de la Mota,* are in the jurisdiction of the Sierra de Pinos, in the kingdom of New Galicia. The result of this commission has not become known.

"The third instance is that stated above, as having occurred in respect to these very mines of el Carro and el Picacho, in the year 1745, when the working of a newly discovered mine of quicksilver was taken up by Don Fermin de Echevers, the president of Guadalaxara. On this occasion, we know from very good authority, that the vein was found to be rich, abundant, and easily worked, and equal to the supply of the whole kingdom of New Spain; and also, that upon the result of the reduction of some of the ore, conducted under the president's orders, the cost of the quicksilver amounted to no more than 22 or 23 dollars per quintal.

"The fourth instance we shall mention, occurred previously to the last, being in the year 1743, early in the viceroyalty of Count Fuenclara, by whose order doctor Pedro Malo da Villavicencio, senior judge of the royal audiency, set out for the purpose of exploring some other quicksilver mines near Temascaltepec, the ores of which had been subjected to several experiments and assays at Mexico, by Don Manuel de Villegas Puente, factor of the royal stores, who now accompanied the senior judge; but their investigations failed of any beneficial result, and it appears that nothing but urgent necessity will ever induce the government to sanction the laws permitting mines of quicksilver to be worked, like those of silver, gold, or any other metal.

"Yet, as it is evident that there are within this kingdom mines of quicksilver, which the crown might at any moment order to be worked, nothing is easier than to demonstrate the expediency of adopting the same plan here, which has succeeded so well in the famous mines of Guancavelica in Peru.* For, first, whenever the supply of quicksilver fails, as has happened times without number, either in consequence of war, of losses at sea, or of the delay attendant upon procuring it from such a distance, the reduction of the ore in the amalgamation works is brought to a stand, the revenue is thrown into arrear, the whole kingdom suffers, the working of the mines is interfered with, and trade receives a check. By setting the quicksilver mines at work, all, or most of these evils, would be remedied, facilities would be afforded for reducing the silver in an expeditious manner, and the amount of the tenths, the one per cent. and the coinage duty would be augmented."

---

* Mota, MS. History of New Galicia, c. 62, n. fin.

In confirmation of the above, it may be added, that other veins of quicksilver, appearing, by the analysis of Professor Del Rio, to afford ores worth working, have recently been discovered in Mexico. Analyses of two specimens of the ore may be seen in the Philosophical Magazine for August, 1828.

Mr. OGDEN's *Marine Steam Engine.*

SIR,—In an account given in a late Liverpool paper of a public dinner of engineers and others, friends to the promotion of steam power, on the 15th of September last, I observe that the health of Mr. Ogden, the consul of the United States, at Liverpool, was proposed by Mr. Vignoles, C. E. and drank with great applause, as the person who was "the first to apply the power of steam to navigation on the ocean." Not being at all aware of Mr. Ogden's claims in this respect, and perceiving that the Editor of the "Mechanics' Magazine" was one of the party who joined in this public acknowledgment of them, I take the liberty of applying to him for some information on the subject. I doubt not that there are many others equally ignorant with myself of the service which Mr. Ogden appears to have rendered to navigation, and to whom a detail of the particulars attending it will be as acceptable as to,

Sir, your obedient servant,

W. H.

Warrington, October 15, 1830.

The grounds on which Mr. Ogden is considered entitled to the honour of being the first to apply steam to navigation *on the ocean*, admit of a very satisfactory explanation. In 1810, Mr. Ogden was engaged in making some experiments with a small steam boat, and then, as we have been informed, first gave his serious attention to the subject of steam navigation. On the following year, he made a plan, and gave a drawing of an engine, to a friend, which he proposed he should adopt for a boat he was about building. Mr. Ogden's attention being diverted from this object by other business, he thought no more of it until 1813, when having again leisure, he matured the plan before alluded to, and obtained a patent for it from the government of the United States. The specification was in the following terms:—"This improvement is predicated on the fact demonstrated by Mr. Watt, that the elasticity of steam being proportionate to its density, its expansion, on being stopped off at one-fourth, one-third, or one-half, the capacity of the cylinder, will produce a power in a much greater ratio than one-fourth, one-third, or one-half of the whole, (vide Encyclopædia, American edition, art. Steam, Plate 478, Fig. 10.) I propose working steam, of whatever density, in two cylinders or other vessels, to be stopped off at any point from one-eighth to one-half. If at one-half, the instant one cylinder is half filled, its steam valve is closed, and that of the other is opened; on its piston arriving at the end of the stroke, that of the other will have performed half a one; *its* steam valve will then be closed; and that of the first again opened, as well as its opposite condensing valve; thus the motion will be regularly continued, each cylinder alternately half filled with steam," &c. &c. Mr. O. further claims as his invention, the application of the powers of the two pistons, in such a manner that they shall act simultaneously on the same axis at right angles with each other. It is plain that when one is at its minimum, the other being at its maximum, will carry it past the point, and that they will mutually tend to equalise the motion, thereby doing away the necessity of balance wheels."

---

* Solorz. Polit. lib. 6, cap. 2.

In 1814, B. H. Latrobe, Esq. an engineer and architect of some celebrity in the United States, constructed the first engine on this principle; not, however, until he had combatted that principle most stoutly; insisting that, from the inequality of their motions, two cranks could never be brought to act together. Mr. Latrobe was induced, however, to try the experiment, and the result was most satisfactory.

In 1815-16, Mr. Ogden built a boat in the neighbourhood of New York, and set up on board of her an engine of two 27 inch cylinders, with a four foot stroke, shutting off the steam at one-half. With this boat he proceeded, in May, 1816, from New York to Virginia, where she was established to run between Norfolk and Richmond. During the passage they encountered a severe gale, when her performance astonished every person, and proved, most satisfactorily to Mr. Ogden's mind, the advantages of steam in any situation. In the autumn of that year, Mr. O. came to this country, and had an engine constructed by Fenton, Murray, and Wood, of Leeds. The same builders afterwards furnished another, from the same patterns, of two 33 inch cylinders, which Mr. O. put on board of a steam tug for the river Mississippi, and which we have heard him say he has frequently seen ascending that stream against a current of three miles and a half with a ship of three or four hundred tons on each side, and two smaller vessels, brigs or schooners, astern.

[*Editor Mechanics' Magazine.*

Description of the various kinds of Paper.

We have been requested to insert the following description of the various kinds of paper, which appeared in the *London Mechanics' Magazine,* for February, 1829. The article, which is understood to be very accurately drawn up, is rarely to be met with at the present time.

The water marks used by the English manufacturers are figured in the original paper, but are here omitted, as having little interest for the American manufacturer, or dealer. Ed.

It was well remarked by the great philosopher, Boyle, that "if every artist would but communicate what new observations occurred to him in the exercise of his trade, the advantages gained to philosophy would be incalculable."

Under a conviction of the extensive application of the above truth, I submit the following information (first collected, with some pains, for my own use,) for insertion in your widely circulated miscellany; and although the title of *new* will not apply to it, yet, as I am not aware of any thing of the kind having before appeared in print, I hope it will be considered sufficiently scientific, and of such general interest, as to procure for it that honour.

Paper may be divided into three distinct classes; viz. writing and drawing papers, printing papers, and wrapping or packing papers.

Fig. 1.

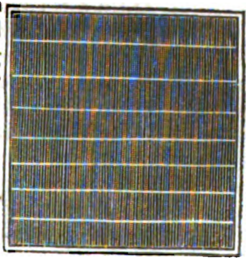
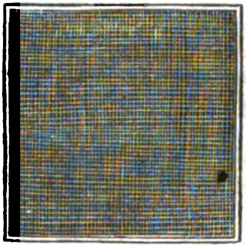


Fig. 2.



First, *Writing or drawing papers*—Writing papers are called either *laid* or *wove,* from the moulds on which they are made. Laid papers retain the marks of the wires in long parallel lines crossed at intervals by other lines, as shown by fig. 1, which is a mould for making laid papers. Wove papers, on the contrary, bear no impression of the wires, the mould used for making them being formed of very fine wire, woven in a manner similar to linen,—whence the derivation of the term *wove.* The appearance of a mould of this description is shown by fig. 2. Laid paper is generally of a bluish cast, which is obtained by adding smalt (the powder blue of commerce) to the pulp while in the vat. Wove paper is of two kinds,—blue wove, and yellow wove; the former of which is made by working the pulp to which smalt has been added, on a wove mould; yellow wove, on the contrary, is the pure colour of the rag, considerably heightened, however, by the process of bleaching. Drawing papers are always of the latter, and writing papers (emphatically so called, from imperial to demy) of the first named description. In describing the numerous varieties of post, copy, foolscap, and post papers, the distinguishing terms, *laid, yellow wove,* or *blue wove,* are always employed. But in all papers, from demy upwards, *wove* and *drawing*, or *laid* and *writing*, are synonymous terms; and where no distinguishing term is used, *laid* is always understood. The following is a list of the papers in this class, with their dimensions, and weight per ream:*—

Name.	*Dimensions.*		*Weight.*
	In.	In.	lbs.
Antiquarian,	52½ by	30½	236
Double Elephant,	39½	26½	140
Atlas,	33	26	100
Colombier,	34½	23	100
Elephant,	29½	21½	72
Imperial,	28	23	72
Super Royal,	27¼	19¼	52
Royal,	23½	19	44
Medium,	22¼	17¼	34
Demy,	19½	15¼	24
Extra large thick Post,	22¼	17¼	25
Ditto ditto thin ditto,			18
Ditto ditto Bank ditto,			13
Ditto large thick ditto,	21	16½	22
Ditto ditto middle ditto,			19
Ditto ditto thin ditto,			16
Ditto ditto Bank ditto,			11
Extra thick ditto,	19	15¼	25
Ditto thick Post,			20
Ditto middle ditto,			17
Ditto thin ditto,			14
Ditto Bank ditto,			7
Copy,	20	16	17
Square Foolscap,	22½	13¼	20
Extra thick ditto,	16½	13¼	18
Foolscap,			15
Post,	15½	12½	10

Drawing papers are not made smaller than demy, and are put up into reams in the flat state. Writing papers, on the contrary, are seldom made larger than imperial, never larger than atlas, and are generally folded in half.

Considerable trouble has at different times been taken in attempting to discover the origin of the names which the several kinds of paper now bear, but without success. Another object of unsatisfactory research, is the origin of the peculiar water marks with which each of the laid papers is distinguished.

---

* A ream of paper consists of twenty quires; viz. eighteen quires of twenty-four unbroken sheets, and two quires of twenty sheets each, defective paper,—one of which is placed at the top, the other at the bottom of the ream, to preserve the inside paper from string marks, and injuries of any other kind. If the two outside quires are replaced by two perfect quires, the ream is stated to be *all insides*. A *printer's ream* consists of twenty-one and a half unbroken quires of twenty-four sheets each, and is called a *perfect ream*.

The derivation of these marks, as well as the time at which they were first used, is mere matter of conjecture; but I am inclined to think, that on their first adoption, a closer relation existed between them and the names of the papers distinguished by them than at present. By a knowledge of these marks, the original size of any paper may be at once discovered, however much it may have been cut, or reduced in size. These remarks apply to the *laid* papers only; in *wove* papers the water marks being always omitted. The post papers are seldom retailed in the folio, *i. e.* the original size, as quoted in the foregoing list, being cut in half, and folded, and ploughed round the edges, forming quarto post, the common letter paper of the shops; this cut and again folded, &c. forms octavo post, or note paper, &c.

Having said thus much of writing paper, I next proceed to the second division of my subject,—*printing papers.* At the head of this extensive and highly useful class stand the plate papers. These papers are of the same size, weight, and quality, as the drawing papers already described,—differing from them, however, in being of a particularly soft nature,—the process of sizing, which gives the firmness *so* necessary in papers intended to be written on, being wholly *omitted in the* manufacture of plate papers. Plate paper is not made smaller than medium,—the size of the plates for a demy book. These papers are, as their name implies, used for copper-plate printing; when the plates are to be coloured, drawing paper is used, then *technically* called *hard plate,* in contradistinction to the former, or *soft plate.*

The following is a list of the other papers in this class, the weights and sizes of which vary greatly, according to the choice of the maker:—

Name.	*Dimensions.*		*Weight.*	
	In.	In.	lbs.	lbs.
Large News,	32	by 22	From 32	to 37
Small ditto,	28	21	23	25
Royal,	25	20	26	28
Medium,	23½	18¾	24	26
Demy,	22½	18	15	21
Short, (or Music,) Demy,	20½	14	25	28
Copy,	20¼	16¼	13	16
Crown,	20	15	7	12
Foolscap,	16½	13¼	9	14
Post,	15½	12¼	9	10½

The three last of these are generally made in the double size. Printing papers are generally of a yellow wove texture, and are not so well sized as the writing papers; but the sizing is not wholly omitted, as, without some portion of it, they would not possess sufficient strength for ordinary purposes.

I have now arrived at the third division of my subject, viz. *wrapping, or packing papers.* This class includes an almost endless variety of sorts and sizes; which, for the sake of perspicuity, I shall notice under the following heads; viz. cartridge papers—blue papers—hand papers—and brown papers.

I. *Cartridge Papers.*

Name.	*Dimensions.*			*Weight.*	
	In.		In.	lbs.	lbs.
Square Cartridge, -	33½	by	21½	From 47	to 50
Double Crown ditto, -	30		20	30	38
Elephant ditto, - -	28		23	48	52
Common size ditto, - -	26		21	40	50
Royal ditto, - -	24		19½	29	32
Demy ditto, - - -	22½		17¾	26	28
Foolscap ditto, - -	16½		13¼	13	15

II. *Blue Papers.*

Name.	*Dimensions.*			*Weight.*	
	In.		In.	lbs.	lbs.
Blue Elephant, - -	28	by	23	30	
Ditto Double Crown, -	30		20	From 20	to 22
Ditto ditto Foolscap, -	26½		16	20	
Ditto ditto Royal, -	25		20	20	to 22
Ditto ditto Demy, - -	22½		18	15	18

III. *Hand (or white brown) papers.*

Name.	*Dimensions.*			*Weight.*	
	In.		In.	lbs.	lbs.
Elephant - - - -	28	by	23	From 30	to 36
Thick Royal Hand -	24½		20½	36	40
Thin ditto ditto - -	24		20	16	20
Curling - - - -	23½		19½	10	12
Lumber hand - - -	22½		18½	13	15
Middle ditto - -	22		17	12	14
Small ditto - - -	20		15	6	10

IV. *Brown papers.*

Name.	*Dimensions.*			*Weight.*	
	In.		In.	lbs.	lbs.
Imperial Cap - - -	29	by	22	From 60	to 84
Bag ditto - - -	23½		19½	36	48
Kentish ditto - - -	21		17½	26	28
Small ditto - - -	20		15	11	12
Double four Pound - -	32		20	56	66
Small ditto ditto - -	28½		17½	42	52

In addition to the above, there are a variety of papers for particular purposes, which do not come under any of the divisions hitherto noticed. I therefore proceed briefly to notice the principal of them, commencing with *blotting paper*, which is well known to every person. It is made of three different sizes; viz. medium, post, and foolscap, of various colours, weights, and quantities. Blotting paper, especially the colourless description, is much used in chemical experiments, for the purpose of filtration; there is, however, a distinct kind of paper made for this purpose, and known by the name of *filtering paper;* it is generally made double crown size, of a thick woolly texture. *Tissue paper* is also too well known to need description, beyond stating that it is made the size of crown, double and single, and demy. A particular species of tissue paper is manufactured and sold under the name of *copying post;* it is wholly destitute of size, and is of a thin absorbent texture; its use is for copying newly written letters. For this purpose it is slightly moistened, and laid on the letter written with *copying ink*, and is subjected to the action of a press, kept in counting-houses for that purpose; on removing the letter from the machine, an accurate facsimile is found transferred to the copying paper, which, pasted into a book, answers all the purpose of the more tedious and laborious methods of transcribing hitherto practised. *Littress* is a kind of smooth cartridge paper, made of two sizes, royal and foolscap, and used wholly for the manufacture of cards. Among the various kinds of paper used by grocers, in addition to many of those already described, there is a thick purple paper, which forms a distinct class, under the tile of

Sugar blues, viz.—

Name.	*Dimensions.*		*Weight.*
	In.	In.	lbs.
Large Lump - - -	22½ by	32	108
Small ditto - - -	28¾	21¾	102
Single Loaf - - -	26¾	19	90
Powder ditto - -	26	18	58
Double ditto - - -	22	15¾	44

There are a species of thick brown papers, made for particular purposes; among which may be placed a large coarse paper for strong packing purposes, known by the name of *Manchester papers; sheathing paper* for ship-builders, and *tip paper* for hatters, are also of a similar description.

It is necessary here to observe, that although I have made a very marked distinction, in the mode of classification which I have adopted, between the two classes of printing and wrapping papers, yet such, in reality, does not exist; as, in some cases, the finest printing papers are applied to wrapping purposes, and many of that class (as regards size, &c.) are made of an inferior quality, for the purpose of wrapping papers,—such, for instance, as the double crowns and demys used by grocers, hatters, &c. &c. In hand papers, again, some irregularity occurs;—elephant, which stands at the head of that class, is almost exclusively used for the manufacture of paper hangings, and is made of various qualities, according to the description of work for which it is intended. The elegant crimson and satin hangings require a paper of the best printing quality; which will not, therefore, with propriety, come under the denomination of *hand paper.* But had these and similar particulars been allowed to interfere with the arrangement I have adopted, much confusion and unnecessary repetition would inevitably have resulted. I have, therefore, given the most usual weights and sizes, which remain much the same, in whatever class the quality of the paper may chance to place it.

Coloured papers is the title of an exceedingly numerous class, which divide themselves into two kinds; viz. those which are made at the paper mill, either by colouring the pulp while in the vat, or by dying the paper afterwards; and those which are made from white papers, by persons following the business of fancy stationers and coloured paper manufacturers. Among the former class we may reckon the coloured drawing papers, for mounting, &c. crayon papers, for draftsmen; coloured printing demy, royals, &c. for the covers of books; and the beautiful tinted post and tissue papers, in such high repute with the fair sex. The second class comprises, in addition to several of the above, coloured double crowns, demys, &c. for posting-bills; coloured foolscaps,—marble, cypress, morocco, with gold and silver papers; as also papers in imitation of the various kinds of woods, tortoise-shell, &c. &c. to which I may add, a paper most beautifully executed in imitation of buhl work. Indeed, the beauty and variety of the papers in this class is such, that to be duly appreciated, they must be seen. Description, were I to attempt it, would be injustice to them.

Several papers are frequently made in the double size,—as was noticed when speaking of printing papers. The dimension of papers, in the double, may be obtained by doubling the smallest admeasurement. Thus, crown, for instance, is 20 inches by 15 inches, and double crown 30 inches by 20 inches, and so with all others.

Hoping at some future time to resume the subject, with an account of the manufacture of paper, and some of the manipulations it afterwards undergoes,

I remain, sir, yours, &c.

WM. BADDELEY, Jun.

Improvement in Watches, being an Account of a new Metallic Alloy for the Pivot Holes of Watches. By MR. J. BENNET.

IN a machine so minute and complicated, and requiring such exactness of movement, as a watch, it is evident that whatever tends to increase or overcome the friction of the different parts, deserves careful and serious attention. At no part of a watch or clock is the quantity of friction of greater consequence than at the pivots, and the holes in which they work. The former are required to be smooth, properly proportioned, and also to be hard, to admit of being as slender as possible; and the latter should be made in such a material, as will generate the least possible friction, be hard enough to prevent the side pressure of the pivot from altering the shape of the holes, and be acted upon as little as possible by the acids, that the oil may be preserved in a pure state.

When watches were first invented, the holes in which the pivots worked were made of brass, and the plates were polished. It was found that the plates tarnished, from the action of the air, and rendered the general appearance of the watch very unsightly; and that the oil in the holes had a tendency to become impure from the action of acids on the brass. Gilding the plates was then resorted to, but with these disadvantages; it softens the plates, and, consequently, the holes; and the nitric acid, mercury, &c. used in gilding, has a very injurious effect on the pivots and oil. Both of these methods having their advantages, and disadvantages, it is difficult to say which is the better of the two.

Ruby, or garnet holes, were then substituted for brass holes; and, by many, these have been considered the *ne plus ultra* of this part of watch-making—a watch being considered valuable in proportion to the number of holes it has jewelled. But experience proves, that when a hardened steel pivot works in a ruby, or garnet hole, the friction may, from a variety of circumstances, be materially increased, instead of diminished by the hole. If it were possible, in *every case*, to have the two surfaces of the steel pivot and ruby hole perfectly smooth, the friction would be but trifling; but it is often very difficult to obtain this, even in the best jewelling. If there should be but the smallest imaginable part of the ruby hole unpolished, the action of that unpolished part on the pivot would be precisely the same as a common grindstone on a chisel or knife; consequently, there would be two rough surfaces rubbing each other, and, thereby, the friction would be very much increased; and ultimately the pivot, being the softer of the two, would be destroyed. The pivots which are nearest the maintaining power, and the balance staff, especially if the balance be heavy, are most affected by bad jewelling, by reason of the greater side pressure they sustain. From this cause proceeds the harsh rubbing sound of the balance staff observable in some jewelled watches. Hence, many of the most eminent watchmakers jewel only in the staff and scape wheel holes. Those who have been accustomed to repair watches with a number of holes jewelled, will have had abundant evidence of the truth of these observations. Mr. Bennett mentions two instances, out of a great number, which came under his observation, as, in them, the objection of bad jewelling, in the ordinary sense, could not be reasonably brought. He repaired, in November, 1829, a celebrated watch given to H. Brougham, Esq. M. P. by the working watchmakers of Liverpool, which is jewelled in every hole. As it is considered to be a specimen of the finest work the art of Liverpool could produce, it is fair to suppose that they would pay particular attention to the jewelling, which certainly is very valuable, both as regards the fineness of the stones, and the beauty of the workmanship. He found that every one of the pivots were cut and threaded by the jewelling, but more especially those nearest the maintaining power; and the polished surfaces of the pivots having been worn off by the roughness of the jewel holes, the dirt, &c. which the oil had collected stained the pivots as black as ink. Now, a watch in this state, is infinitely worse than one with common brass holes, as the only remedy is to have new pivots and holes, the expense of which would be almost equal to that of a new movement; not to mention the gradual increase of friction and consequent continual change in the rate of performance of the watch. The other instance, was a very superior carriage watch, by Tregent, made for the late Duke of Kent, and now in the possession of the Duke of Sussex, in which the staff pivots were nearly cut through by the jewel holes, it having a *very heavy balance.* This illustrates a foregoing observation, that, in proportion as the side pressure the pivots sustain is greater, jewel holes tend, *above any other,* to increase the friction. A new staff was put to this watch, and the same process went on.

Watches have been made with steel holes, but these have never answered the purpose, for several reasons; principally, on account of the constant liability to attraction, between the pivot and hole from magnetic influence, the friction caused by two metals of the same kind rubbing each other, and the disposition to oxidize.

Gold has also in some cases been used, but, by reason of its softness, it is objectionable both on account of the side pressure of the pivot, and the difficulty of getting a perfectly round hole.

What appears to be wanted to obviate the objections to which the holes above mentioned are liable, is, to obtain a *metal* that shall preserve the oil in a pure fluid state, be subject as little as possible to friction, and be *softer* than the pivot, for, it is of more consequence to preserve uninjured the pivot than the hole. Mr. Bennett tried various metals both simple and compound, to procure one having these advantages:—

Platina he found objectionable on three grounds; viz.—difficulty of working;—deteriorating effect upon the oil;—and too soft to bear the side pressure of the pivots.

An alloy consisting of 3 dwt. of pure gold, 7 grains of silver, and 8 grains of steel, proved too brittle, and to possess a very coarse grain. Another alloy, prepared nearly similar to the foregoing, but having the addition of 3 dwt. 18 grains of platina, and 1 dwt. of copper, was found to have analogous properties.

A compound of 1 dwt. pure gold, 1 dwt. copper, ½ dwt. silver, and 6 grains zinc, proved very malleable, was nearly as hard as brass, and produced much less friction.

The following alloy, however, proved eminently successful; viz.—3 dwt. of pure gold, 1 dwt. 20 grains of silver, 3 dwt. 20 grains of copper, and 1 dwt. of palladium. The palladium readily united with the other metals, and the alloy fused at a temperature rather below that required for melting gold in a separate state. It was very nearly as hard as wrought-iron, and not so brittle but that it could be drawn into wire. Its colour was a reddish brown. Its grain on breaking as fine as steel. It takes a very beautiful polish; and the friction with steel was very much less than that of brass and steel, or the previously mentioned alloy with steel. It works well. Nitric acid has no sensible effect upon this alloy. Mr. Bennett has constructed a watch, and made the holes of this metal, and it answers fully his expeotations, as regards its degree of hardness, its suffering the oil to remain in a pure fluid state, and its little susceptibility of friction. It produces much less friction than the jewel hole, especially supposing the jewel not to be perfectly well polished; besides that, it will not *wear the pivot* nor be affected by the acid particles which may be contained in the oil. And with regard to expense, it has a decided advantage over the jewel hole,—as the expense of jewelling all the holes of a watch would be from £6 to £9, whereas the same number of holes may be made of this metal for as many shillings. [*Register of Arts.*

The Chemistry of the Arts, being a practical display of the Arts and Manufactures which depend on Chemical Principles, on the basis of Gray's Operative Chemist. By Arthur L. Porter, late Professor of Chemistry in the University of Vermont. *Carey & Lea*, 1830.

[Concluded from page 68.]

The Liming.

For this purpose take one bushel of good quicklime, and reduce it by *slaking* to a dry powder; introduce it into a vessel capable of containing from 60 to 80 gallons, (a common rum puncheon answers a good purpose,) and fill it with water; agitate the mixture by stirring, till it acquire the consistence of milk; lay into the bottom of the keir a stratum of cloth, having the bands of the folded piece previously made very loose, and while one man is employed in stirring the lime mixture, let another dash a bucket or two of it over the cloth, which being previously wet, absorbs the liquid very readily; let another layer be put in and wet down with the lime mixture, and so on till the operation is completed. As the mixture gets low, and of a thicker consistence in the lime cask, more water must be added till the lime is all used, and the cloth all in the keir; it is better, indeed, to add a fresh bucket of water to the mixture for every bucket that is withdrawn, till towards the very last of the lot. The manipulations in this stage of the business will be very easily comprehended when it is understood that the object is to diffuse a bushel of lime as equally as possible through a quantity of water sufficient to fill the keir to the grating, upon which the cloth rests, which will require from 300 to 400 ale gallons, and to spread this mixture evenly over the cloth. The agitation of the lime liquor must not be so violent as to keep suspended any lumps of lime that may remain in the powder after slaking, which must be rejected at the last; for such is the activity of this agent, that it is sure to endanger the fabric where it is allowed to remain in any considerable quantity in contact with it during the boil. The cloth should be heaped a little about the vomiting pipe, so that the liquor as it falls from the pipe may subside more towards the side of the keir than it otherwise would do; much, however, depends upon the exact form of the pipe, and the violence of the ebullition; it should be the bleacher's aim to watch the boiling carefully, and adopt such little expedients from time to time as may ensure a regular and even distribution of the liquor over the surface of the cloth, and percolation through it; this is important in all the boilings, but particularly in the liming, where, owing to the very sparing solubility of the lime, an uneven distribution of the liquor may not only fail to produce the necessary effect upon some unexposed portions of the goods, but, by an unequal deposition of the solid particles of lime, produce such an accumulation upon other portions as to injure the texture. The fire may be kindled under the keir as soon as the first layer of cloth is introduced, and wetted with the lime liquor. The boiling should be kept up briskly, at least eight hours; ten hours boiling will not endanger the cloth;—it is a good rule to boil in this as well as in the subsequent buckings in potash nine hours.*

As soon as the boiling is completed, the goods may be cooled down by the admission of cold water, and removed from the keir. When taken from the keir the pieces are to be loosed from the band; edged up, (that is, pulled over from end to end by one selvage to shake out the folds and *crimps*,) and carried to the dash wheel. Owing to the insolubility of the lime, the washing out of this boiling requires greater attention than from any other. Some bleachers edge up and wash a second time before the potash boil; but this is unnecessary. If the dash wheel be well supplied with water, ten minutes washing is generally sufficient for any purpose; the best criterion, however, by which to judge of the amount of washing required out of either the lime or the potash boiling, is the colour of the water which runs from the dash wheel; when this ceases to be muddy, or discoloured, we may safely infer that the washing has been sufficient. From the dash wheel the pieces are thrown again into bundles, preparatory to the

---

* The whale boiler, or keir, so called, is now almost universally adopted in bleacheries, both in England and the United States. The bottom is composed of iron or copper, with a broad horizontal flanch turned up at the outer edges, to which a wooden curb is attached by bolts and nuts. This curb is usually made widest at the top; the dimensions of a curb for boiling 30 cwt. of cloth, are usually 7 feet deep, 6 feet diameter at bottom, (that is, the grate upon which the cloth rests,) and 7 feet at the top. The bottom part should have a capacity of 300 to 400 gallons. A vertical metallic tube, 5 inches diameter, and open at both ends, is firmly attached to the grate by a side flanch, and terminates below the grate within two or three inches of the bottom of the keir, and above the grate within six or eight inches of the top of the curb. This tube is generally made too small, and does not allow the liquor to pass up as freely as it should do. But the particular object of this note is to point out the advantage of reversing the form of the curb, and placing the largest diameter at bottom, and the smallest at top. The object of this change in the form is to obviate a difficulty which bleachers often experience in the common keir, that of the goods rising in the curb, and pressing up the cover, to the great loss of heat, and sometimes to the complete defeat of the boiling; for after the cloth has once risen in this way, it is very difficult to get it back again till the keir is cooled down. I have tried the change proposed with great advantage, and indeed with complete success, in obviating the difficulty mentioned.

With regard to the question, whether the employment of steam, or the direct application of fire to the keir be most advantageous, I do not consider it an important one, but prefer the latter; first, because a little higher temperature may in this way be obtained than can be conveniently obtained by steam; and, secondly, because the apparatus may be constructed at a less cost in the first instance, and maintained at less expense for repairs. I need scarcely add, that where steam is employed for this purpose, that the keirs may be constructed wholly of wood.

First Potash Boiling.

Dissolve in an iron kettle, by heat, 100 lbs. of the best American potash, in 25 gallons of water; add to this solution while hot, 25 lbs. of fresh slaked lime, and stir the mixture half an hour; allow it to stand till the sediment subsides, and then lade off the clear liquor into another clean iron vessel. This is a standard potash ley, each gallon of which contains four pounds of potash, and should have a specific gravity of 58° Tweedale's hydrometer. Put 16¾ gallons of this solution into the boiling keir, and add water till it stand 6 to 8 inches above the grate; kindle a fire under the keir and lay in the cloth with the bands of the bundles quite loose; proceed in the boiling in all respects as in the boiling in lime, and keep up a brisk ebullition 8 or 9 hours. It is usual to put the goods into the keir in the morning, and, after boiling, to allow them to remain in it over night, and cool gradually. This will answer very well in the potash boiling; but after the boiling in lime, I should hesitate to allow the cloth to lie in the keir over night without being previously cooled down by the admission of water. In cases of great urgency, it is practicable to buck twice in twenty-four hours.

From the boiling keir the cloth is again returned to the wash wheel. It is not necessary to edge up the pieces in this washing. The liquor remaining in the keir after boiling is very dark coloured, and surcharged with the colouring matter of the cloth; it has lost in a great measure its causticity; if muriatic acid be added to a portion of this liquor, the colouring matter is precipitated of a dark greenish hue. By evaporating this residuum liquor till it acquire the consistence of thick treacle, and then exposing it to the heat of a reverberatory furnace; the vegetable matter may be burned out and dissipated, and the alkali recovered in the form of pearl ash, or the subcarbonate of potash. This was formerly practised in England, but has, I believe, now fallen into disuse. The expediency of it depends wholly on the relative value of the alkali on the one hand, and of labour and fuel on the other. Where fuel and labour are comparatively cheap, and the alkali high priced, as in Lancashire in England, this may, in some instances, be an economical practice; but where the reverse of this is true, as in the United States, the product would scarcely reward the attempt. After washing, the cloth is allowed to drain, and is then prepared for the solution of chloride of lime.

Blanching Liquor.

The solution of the chloride of lime is known to English workmen, and, I believe, very generally to our own, by the vulgar appellation of *chemic*, a term scarcely to be tolerated in a work having the least pretensions to scientific propriety. As a popular name, however, seems almost indispensable in a treatise designed for practical men, I shall designate it by the more appropriate appellation of *blanching liquor*. It is prepared by adding 50 lbs. of the best chloride of lime, or bleaching powder, to 50 gallons of water, stirring the liquor occasionally for ten or twelve hours, and then leaving it to settle; it is most convenient to commence this process in the early part of the day, and allow the liquor to stand over night; by this means a firmer sediment is obtained, and the clear liquor is more perfectly separated from it. Add this clear solution to a sufficient quantity of water for covering the lot of cloth, (2000 lbs. as before mentioned.) The goods are to be immersed in this liquor, and particular care must be used that the bands be quite loose, and that the quantity of liquor be sufficient to cover the pieces without compressing them too hard. This solution is not so penetrating as the acid liquor, and the cisterns should have a capacity compared with the cisterns for the sours, as 4 to 3, in order that the cloth may be more fully exposed to the action of the liquid. Two thousand pounds of cloth will require for the solution of chloride of lime a capacity of about 360 cubic feet, and for the sours 270. The cloth should remain in the blanching liquor about 10 hours. It is then thrown upon a grated wooden flooring which extends about one-half the cistern, and after draining an hour or two, is ready for

The First, or Brown Sours.

Fill the cisterns for the reception of the goods to within three-fourths of their depths of the top with water, and add to it 40 lbs. of concentrated oil of vitriol, and stir the mixture well till the acid and water be thoroughly incorporated. The liquid will then have a specific gravity of 1½° or 2° on Tweedale's hydrometer, and a degree of acidity to the taste, about equal to that of lime or lemon juice. As the souring liquor is not often entirely changed, no very exact rule can be given for replenishing the cisterns with acid; as a general rule, however, 40 lbs. of concentrated vitriol per ton of cloth for each souring will be found sufficient. The specific gravity may be some guide, but this is liable to be influenced by other matters derived from the cloth. On the whole, the taste is the surest guide for the practical bleacher. Goods are rarely injured by too strong sours, if proper precaution be taken to prevent any parts of them from drying with the acid in them; if this precaution be neglected, the destruction of the fabric is certain;—the reason is obvious,—if the cloth dry with the souring liquor in it, the watery parts alone evaporate, and from being impregnated with a very diluted, it becomes intimately united with a highly concentrated acid; on this account it is always better where the goods cannot be washed out of the sours, after the usual time, to allow them to remain in the liquor, in preference to leaving them long exposed to the air; or, if it be necessary to withdraw them from the liquor to make room for another lot, they should be kept wet and excluded as much as possible from the atmosphere. Damage from this source is always to be suspected where certain circumscribed spots of bleached cloths are observed to be tender, while the general texture of the fabric is sound. Ten or twelve hours immersion in the sours is sufficient, but an hour or two, more or less, is not material. After draining, return the goods to the dash wheel.

Second Potash Boiling.

The method of proceeding in this is precisely the same as in the first boiling in potash, except that only one-half the quantity of potash is used. The boiling, washing, blanching, and souring operations, are repeated in the same order and manner as already described. As the goods are, however, become more free from colouring matter, it is important that the second souring and blanching operations should be performed in separate cisterns; these cisterns are generally called by the workmen the *white chemic* and *white sours*, in contradistinction from the first liquors denominated the *brown* chemic and sours. The liquor of the brown sours should be changed after every 20 or 30 operations; but those of the other cisterns not oftener than once a year, if proper precautions be taken to preserve them from accidental impurities. Great care should be used that the cloth be thoroughly washed out of the last sours; for, if any acid remain in the cloth when dry, it certainly will be injured. In all the other washing it is usual to wash two pieces in each compartment of the dash wheel; but, in order to ensure a perfect washing out of the last sours, it is better to put only one piece in a compartment.

After the last washing the goods are passed through a trough of clear water, squeezed, and dried.

The order of the processes, then, as described in the foregoing remarks, are summarily these:—

1. Steep.
2. Wash.
3. Boil in one bushel of lime.
4. Wash and edge up.
5. Boil in 67 lbs. of potash.
6. Wash.
7. Immerse in a solution of 50 lbs. of chloride of lime.
8. Immerse in sours containing 40 lbs. of oil of vitriol.
9. Wash.
10. Boil in 33 lbs. potash.

11. Wash.
12. Immerse in the solution of chloride of lime.]
13. Sour as before.
14. Wash.
15. Rinse and squeeze.

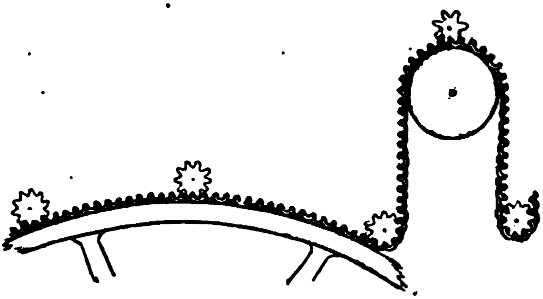
The whole amount of materials used is one bushel of lime, 100 lbs. of potash, 50 lbs. of chloride of lime, and 40 lbs. of oil of vitriol for 2000 lbs. of cloth.

Improved gearing Chain.

An ingenious and useful construction of gearing chain for connecting cog wheels, has lately been invented by Mr. Oldham, engineer, of the Bank of Ireland, which we think highly deserving of the attention of machinists, as it is so extensively applicable to various kinds of machinery, such as carding engines; and indeed in almost every situation where a series of toothed wheels are required to be driven by one mover. It consists of a peculiarly constructed chain, with curved links, which when passed round a drum will serve as teeth, and act as a cog wheel to turn pinions, &c. and when stretched out straight, or placed on a flat surface, will form an endless rack. It may also be passed over and under a series of rollers, pinions, &c. forming a carrying chain instead of the commonly constructed chains, in which spiked wheels are employed to take into the links.

In carding engines, and various other kinds of machinery, this improved chain will work with much better effect in connexion with pinions, or wheels with common teeth, into which it is suited to gear, than the old chains, and without the possibility of slipping off, or riding over the points of spiked wheels; having a broader surface of contact: and it is not at all liable to get out of order, being much stronger than the old linked chain used with spur pinions.

Fig. 1.



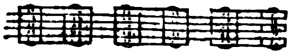


Fig. 3.

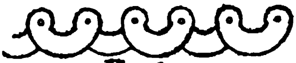


Fig. 2.

Fig. 1, is a side view of a portion of the improved chain. Fig. 2, is a plain view of the same; it is formed by crescent shaped plates constituting links, which are connected together: one and two plates alternately, or two and three, or more placed side by side; the alternate links fitting in between each other at the joints, where they are connected by pins, or bolts passed through their eyes in lateral directions.

It will be seen that these curved links present on one surface of the chain semicircular hollows like a rack, for the teeth of the pinions to take into, and that the ends of the links, where the bolts or rivets are passed through are also formed semicircular, and the same size as the spaces or hollows of the links. These ends constitute teeth on the chain, and take into the spaces between the teeth of the pinions or wheels, and consequently drive them; or the chain itself may be driven by such pinions or wheels in the same way as a rack.

It is obvious that such a chain may be passed in various directions over wheels, on its face, and over drums at its back, and may be used with certainty of effect: as whatever motion is given to the chain, will be communicated to all that is in gear with it.

Fig. 3, shows such a chain, supposed to be endless, carried over part of the periphery of a carding cylinder, and constituting a circular rack or tooth rim, which drives all the pinions connected to it; the back of the chain is conducted over a roller, and brought into gear with other pinions or wheels; but as numerous illustrations might be produced of its applicability, it is unnecessary to say more, as its adaptation to a very wide range of machinery will at once be perceived by every practical mechanic.

Improved mode of coupling Machine Bands or Straps.

Mr. E. Budding, of Stroud, Gloucester, the recent Patentee of an ingenious machine for mowing lawns, has lately invented a new mode of uniting the ends of leather straps or bands, employed in driving machinery, which, from its simplicity and perfect security, will beyond all doubt, be adopted in every mill and manufactory where leather strapping is made use of, instead of lacing, thongs, rivets, or buckles.

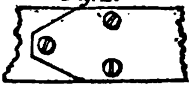
In some mills where very long bands or straps are used, it is customary to secure the several pieces together by rivets, to form the whole length of strap; and to attach the two extreme ends by lacings, so as to allow of adjustment. This mode of fastening is objectionable, as the hammering of the rivet, unless very carefully done, is liable to bruise and injure the leather, and frequently causes it to break at such parts when in use; beside to make a secure joint, many rivets must be used, which is both expensive and troublesome.

Fastening straps with lacings or thongs is also objectionable, as they require many holes to be pierced through the straps, which weakens them, and when they require adjusting, a considerable time is lost in unlacing and lacing them again, to take up a hole; during which time the machinery must stand still: and the lacings, in passing over the drums, are often cut, and very soon wear through, thus producing delay and expense, and injury to the machinery. These disadvantages are so well known to all practical men, who have the superintendence of machinery, that we feel convinced any attempt to obviate them will be acceptable to our readers.

Mr. Budding's plan consists in employing studs, or metallic buttons, the shanks or stems of which are hollow sockets, having a female screw cut in them. The stem or shank is as long as the thickness of the two pieces of strap when combined, and is made truly cylindrical, fitting the holes punched in the straps at the proper places of union. When the holes in the ends of the strap are brought together, the socket or shank of the stud is introduced through them, with the button or disk on the underside, and a screw with a large flat head is screwed tightly into the socket of the button, which compresses the leather between the button, and the screw head, as it becomes tightened up, and keeps the two pieces in close contact, producing a tight and secure joint; the strap being as pliable at the junction as at any other part.

Fig. 1, is a view of the two pieces of strap fastened together, as seen on the upperside; Fig. 2, is an edge view of the same; Fig. 3, is a representation of the button or disk with its socket, rim, and the top screw, separated from each other; Fig. 4, a representation of them when put together.

Fig. 1.



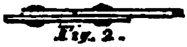
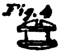


Fig. 2.

Fig. 4



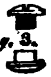


Fig. 3.

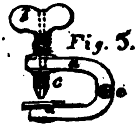


Fig. 5.

When two pieces of strap are to be united, it is only necessary to punch the holes of the proper size, to suit the stem of the button intended to be used, and on bringing them together, the socket is to be introduced through them, and then the large headed screw introduced into the socket and screwed tight up.

It is obvious that this operation will take but little time, and a strap can be unfastened and a hole let out, or taken up and fastened again in a few seconds.

Straps of considerable strength and thickness, will require different sized buttons and stems, according to the rate at which they are intended to work. They are generally used three together for securing one junction of the straps, for all ordinary purposes of machinery; but for a steam engine strap perhaps five may be required: more than five is seldom necessary, unless to an engine of very great power.

The operation of attaching the straps by these studs is greatly facilitated by the use of a punch of a rather novel construction, likewise invented by Mr. Budding, the form of which is shown in Fig. 5. It consists of a clamp *a*, through which is passed the thumb screw *b*, on the lower end of which is the punch *c*. When the straps are adjusted, they are held between the clamp as at *d*, and the thumb screws turned round, when the punch will cut a perfectly clean hole through both straps at once.

On the band of the clamp is the concave piece of steel *e*, which is file cut on its surface; when the socket of the button has been introduced into the hole, this concave piece is placed against the button, at the underside of the strap, and held in contact with it, while the screw is driven up tight, the rough file cut surface preventing the button from slipping round. Different sized punches may be fitted to the thumb screw or clamp, to suit the sockets of the different sized buttons, some of which are made small enough to connect the leather straps of carriage harness, and it would be very advantageous if stage coachmen and guards were to carry a few of these buttons in their waistcoat pockets, in case of accident,

These studs are sold from 3*s.* to 4*s.* 6*d.* per dozen, according to the size.

First Steam Communication with India.

[From the United Service Journal.]

It has for some time been a favourite object of sir John Malcolm, governor of Bombay, to establish a steam conveyance for despatches between that place and England, *via* the Red Sea, Suez, and Alexandria. A vessel called the *Hugh Lindsay*, of 400 tons burthen, with two engines of eighty horse power each, was accordingly built for this purpose, at an expense of at least 40,000*l.* Though constructed upon such a costly scale, yet the unaccountable blunder was committed, of her not having capacity to carry more than six *days' coal;* when it is impossible she could reach the Arabian coast from India in less than eight or ten days. If every thing, however, had been properly managed, the mails might have reached Alexandria in twenty-three days; from thence to Malta would have occupied four days more; thence to Marseilles four days; thence to England five days: total from Bombay to London, under favourable circumstances, only thirty-six days! As it was, the *Hugh Lindsay*, commanded by Captain Wilson, sailed from Bombay, and reached Suez in thirty-three days, having lost twelve days in the ports of Aden, Mocha, Judda, and Cosseir, being detained in getting supplies of coal on board at those places. The letters sent by this vessel, after all, reached England in less time than any were ever received before from India. Col. Campbell was the only passenger by her, probably from want of room, as the cabin and every other place was occupied by the coal. She was so deep in the water on leaving Bombay, that she was *à fleur d'eau*, and her wheels could hardly revolve. The distances between the several places on her route are as follow:—

From Bombay to Aden,	1710 miles.
Aden to Mocha,	146
Mocha to Judda,	556
Judda to Cosseir,	430
Cosseir to Suez,	261
	3103

which, at twenty days' navigation, would give 155 miles a day, or six miles and a fraction per hour. The despatches by steam, therefore, ought to go from Bombay to Cosseir in fifteen days; from thence to Alexandria by a dromedary *direct*, without stopping at Grand Cairo, seven days; Alexandria to Malta four days, and so on as before mentioned, making in all from Bombay to England thirty-six days; or allowing for casualties, the mails might fairly be considered due in forty days.

We have been favoured with an inspection of the following letter from an officer belonging to the *Hugh Lindsay*, detailing the operations of that vessel in this first attempt to establish a steam conveyance upon that sea, where the Lord opened a path for the Israelites of old, and where the proud Pharaoh and all his host so miserably perished. Surely, no subject can be more generally interesting, not only to the people of Great Britain, but to every nation of Europe:—

"Sir,—I have much pleasure in acquainting you with the arrival of the *Hugh Lindsay* at Suez, this day, from Bombay, which place she left on the 20th of March. The passage has occupied more time than was expected, owing to the delay occasioned by receiving coal at Aden and Judda. At the former place we were detained *six* days, and at Judda *five*. We also touched at Mocha, which detained us a day. The present trip being an experiment, I was instructed, if time permitted, to visit you at Alexandria, for the purpose of communicating with you on the subject of steam navigation in the Red Sea; but the season being now so far advanced, it is necessary we should use the utmost despatch to ensure our return to Bombay, previous to the setting in of the southwest monsoon, for which reason we shall leave Suez as soon as we have received what coal there is. We touch at Cosseir to take what fuel is there also, and we are apprehensive we shall find scarcely enough on the Red Sea to take us to Bombay.

"The *Hugh Lindsay* is 411 tons burthen, and has two 80 horse engines. By the builder's plan, she appears to have been intended to carry about six days' coal; but, in order to make the passage from Bombay to Aden, she was laden as deep as could be, and left with her transom in the water. Notwithstanding, on our arrival at Aden, after a passage of eleven days, we had only about six hours' coal remaining; which circumstance alone shows her unfit for the performance of the passage. Her being so deep, too, materially affected her speed. I met with greater detention in getting off coal at Aden and Judda than I had anticipated. Arrangements might be made to expedite the shipment of coal at those places, but I am now of opinion the fewer depots the better, and that if steamers were built of a class that would be propelled by engines whose consumption would not exceed nine tons of coal in the twenty-four hours, and which should carry conveniently fifteen days' coal at that rate of consumption, then the navigation of the Red Sea would be best carried on in two stages, one from Bombay to Aden, and from thence to Cosseir or Suez direct. I think, too, there is no necessity for proceeding up so far as Suez, as every object might be equally well attained by going to Cosseir only. As far as the passengers are concerned, the majority I should suppose would prefer being landed at that place, for the purpose of viewing the antiquities on the route from thence to Alexandria, and the arrival of despatches would be very little delayed, when we take into account the time occupied by a steamer, on going from the parallel of Cosseir to Suez, which, when northwest winds prevail, could not be done in less than two days and a half.

"I enclose a copy of the log of the *Hugh Lindsay*, from Bombay to Suez, conceiving it might possess some interest, as the journal of the first steam vessel which has ever navigated the Red Sea.

"I am, sir, &c.

"*Hon. Company's Armed Steamer, Hugh Lindsay, Suez, April 22*, 1830."

On the Resistance of Lead to Pressure, and on the Influence of a small Quantity of Oxide upon its Hardness.

THE recent experiments of Mr. Bevan on the compression of lead,[*] and his proposal of applying balls of that metal to estimate the force of presses, screws, &c. must be well known to English readers. A similar investigation has been entered into by M. Coriolis, which, however, is much more refined as regards those circumstances that enable the lead to resist the force applied.

The points at first under investigation by the latter philosopher were temperature, time, impact, and state of the surfaces between which the lead was confined. The pieces of lead were cylinders 24 millimetres in diameter, and 19 in height; weighing each from 100 to 101 grammes. The arbitrary scale of measurement used gave 680 divisions for the 19 millimetres of height. The lead was pressed between two plates of iron in a kind of box, allowing lateral enlargement as the pressure was exerted, and the measurements of thickness were taken by means rendering the estimation very delicate.

To remove any irregularity resulting from differences in the times of pressure, it was in all ordinary cases limited to an exact minute. To ascertain the effect of impact, two pieces, which had been pressed equally, were then re-pressed, the one for two minutes, the other also for two minutes, but at eight different operations. On making thus the effect of impact eight times as much in one case as in the other, still the whole difference was only 19 divisions, which, divided amongst the extra 7 impacts, gives only about 3 divisions for each. As to the original temperature, its effect amounts to little or nothing; for when the cylinders were purposely cooled down, the mere effect of compression evolved so much heat that they could scarcely be touched, and this heat soon overpowered the original difference: experimentally no sensible difference was produced. In reference to the influence exerted by the state of the surfaces between which the lead was pressed, this also proved to be insensible.

---

[*] Quarterly Journal of Science, N. S. vol. vi. p. 392.

In the experiments the results are always expressed by the number of divisions to which the thickness of the lead has been reduced from the original standard thickness of 680 parts; and in this abstract we shall only give the mean results. Under the following pressures the ordinary lead used in mints was reduced to the expressed thickness.

Kilogrammes - -	1500	1824	1950	3175
Thickness - - -	463	336	337	296

When this lead was re-fused and cast, it was found to have increased so much in hardness, as with 1500 kilogrammes to give 490 degrees.

Lead was then reduced from the carbonate, and tried after being fused and cast once, twice, thrice, &c. care being taken as much as possible to prevent oxidation by the use of tallow, charcoal, &c. upon the surface. By the pressure of 1950 kilogrammes it was, after the first fusion, reduced to 333 degrees; after the second to 351; after the third, to 398, always setting off from the standard thickness of 680.

This effect was referred to a small quantity of oxide introduced into the lead at each time of pouring. To ascertain the truth of this opinion, a stopcock was attached to the bottom of the melting vessel so that the lead could be drawn off without any contact with the atmosphere, the surface above being covered all the time with a thick layer of charcoal powder. Then the former experiments being repeated, it was found that lead, after the first fusion, was reduced to 303, less than on any former occasion; after a second, to 311; and, after a third, to 301; so that now no repetition of fusion produced any effect. Some of the lead was also cast in this way, being first raised to a cherry-red heat, and others only to the lowest point necessary for liquefaction. The effects were the same in both; no influence had been exerted over the hardness of the metal, and the changes which usually occur are due to a little oxide introduced.

In experiments upon the influence of time it was found that, after a minute had elapsed, the effect of time was masked by the general effect of the metal, and nearly hidden. For a charge of 1950 kilogrammes the compressions were as follows:—

Time -	30″	45″	60″	75″	90″	120″
Thickness	365	331	322	321	319	313

So that here, after a minute, 10″ produced an effect of only 2 degrees upon the scale. Still it was found the effect did proceed; for with a charge of 1760 kilogrammes the effect was as follows:—

Time - - -	1 minute	1 hour	24 hours
Thickness	317	245	223

So that after 24 hours, the lead still continued to give way.

The most important conclusion from these experiments is, that lead fused and cast in the open air is of variable hardness, and that to obtain it with its true and constant power of resistance, it must be cast out of contact with the air, and drawn off from the bottom of the mass.* [*Journal of the Royal Institution.*

Resistance opposed to Water moving in Pipes.—(D'Aubuisson.)

Notwithstanding the endeavours made to deduce formulæ from experiments on the passage of water through tubes, so as to assist and guide the engineer in laying down pipes to supply manufactories or towns, yet frequent mistakes have occurred: thus at Paris, at the Fontaine des Innocens, only two-thirds of the water calculated upon were obtained; whilst, in the faubourg St. Victor, only the half of that expected issued from the pipes. These differences appear to result from experiments made on too small a scale, or with apertures disproportionate to the areas of the tubes; for the results of practice come sufficiently near to the formulæ of MM. Prony and Eytelwein, when the velocity of motion in a pipe was small in consequence of a contracted aperture made in a plate of metal being used. When the contracting plate was altogether removed, then the product in water was a fourth or third less than that given by the formulæ, from which M. D'Aubuisson concludes that the resistance increases with the velocity in a greater ratio than that given to it in the calculations; where it is supposed to increase proportionably as $v^2 + m v$, m being nearly equal to 0.055, and v representing the mean velocity.

In consequence of the arrangement and state of the water-pipes at Toulouse, some large and accurate experiments have been made there by MM. Castel and D'Aubuisson, the systems of pipes of 4.7 inches and 10.63 inches in diameter, and 1434 and 1986 feet in length. In these experiments the quantity of water passed and the pressure were varied; the results were noted, and also calculated by the formulæ, so as to deduce the loss of pressure due to the resistance of the pipes: that by calculation came out 27., 25., 32.7, and 31.7 per cent. below the result of experiment. As the two latter were the principal experiments, it is concluded that, generally, calculation gives the resistance nearly one-third less than what is obtained by actual and careful practice.† [*Ibid.*

---

* Annales de Chimie, xliv. p. 103. † Ibid. xliii. p. 224.

To our Readers.

We place upon the last page of the Journal, a meteorological table, for the month of January.

The Institute have made arrangements by which a similar report will be secured to our readers monthly, and a committee has been appointed charged with this object.

Particulars in relation to the locality of the observations, to the instruments used, &c. will appear in our next number.

Committee on Publications.

Meteorological observations for January, 1831.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain and snow.	State of the weather, and Remarks.
		Sun rise.	2 P.M	Sun rise.	2, P. M.	Direction.	Force.		
				Inches	Inches.			Inches.	
	1	33°	36°	29.70	29.80	West.	Blustering.		Clear. Cloudy.
	2	28	38	30.10	30.20	do.	Moderate.		Clear. Clear.
	3	27	46	.20	.20	W. S.	do.		Clear. Cloudy.
	4	51	59	29.70	29.70	S. S. E.	do.	.90	Cloudy. Rain.
☾	5	57	42	.70	.70	S. W.	Lighter.	1.00	Rain. Rain.
	6	26	34	30.10	30.12	West.	do.		Clear. Clear.
	7	26	41	.10	.12	do.	do.		Clear. Clear.
	8	32	40	.13	.9	N. E.	do.		Cl'dy--cl'dy--hail at night.
	9	30	31	29.85	29.85	do.	do.	.65	Sleet. Snow.
	10	24	27	.73	.75	do.	do.	.50	Snow. Snow.
	11	23	32	.90	.85	do.	do.		Snow. Drizzle.
	12	26	26	.85	30.00	W. N. W.	do.		Clear. Clear.
⊗	13	8	16	30.03	.35	West.	do.		Clear—clear—very cold.
	14	20	20	.20	·10	N. E. S.	do.		Cl'dy-cl'dy--rain in night.
	15	20	23	29.33	29.30	N. E.'	High.	.85	Snow—much drifted.
	16	18	24	.40	.40	West. E.	Blustering.	.45	Snow cont'd—18 in. deep.
	17	20	20	.40	.70	do.	Moderate.		Flying cl'ds—*nav. obstr'd.*
	18	8	24	.70	.60	do.	do.		Cl'dy—cl'dy—slight snow.
	19	21	32	.60	.53	do.	do.		Clear—good sleighing.
	20	23	39	.50	.50	S. W.	do.		Clear. Cloudy.
☽	21	14	20	.80	.80	S. E.	do.	.24	Clear—cloudy—snow 2 in.
	22	11	26	.40	.40	West.	Blustering.		Cl'dy-clear--fine sleighing.
	23	10	16	.60	.60	do.	do.		Clear day.
	24	7	20	.75	.75	do.	Calm.		Cloudy--clear--*Delaware frozen.*
	25	0	14	.70	70	do.	Moderate.		Clear day.
	26	6	24	.70	.70	do.	do.		Do.
☺	27	14	26	.70	.73	do.	do.		Do.
	28	16	30	30.00	30.00	do.	do.		Do. Cloudy.
	29	24	34	29.90	29.80	do.	do.	.60	Cloudy—slight snow.
	30	18	26	.87	.90	do.	do.		Clear. Clear.
	31	12	32	.90	.83	W. South.	do.		Cloudy Cloudy.
				mdn't	.23			.90	Snow, hail, and rain in night.
	Mean	21 1	29 6	29.48	29.48			6.09	

	Thermometer.		Barometer.	
Maximum height during the month,	59.	on the 4th,	30.70	on the 2nd.
Minimum do.	0.	on the 25th,	29.30	on the 15th.
Mean do.	25.3		29.48	

Water fallen in snow and rain, 6.09 inches.

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

MARCH, 1831.

Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain by experiment the value of Water as a Moving Power.*

The importance of accurate knowledge in relation to the effect of water as a moving power, and the defective state of information upon that subject, induced the Franklin Institute, in the spring of 1829, to determine that a series of experiments should be made, under its direction, upon the force of water applied by wheels; the experiments to be in detail, and upon a scale calculated to give confidence in the practical nature of their results. A call was to be made upon the members, and upon that portion of the public interested in the proposed researches, for aid, to enable the Institute to effect the object in view.

To obtain this aid, and execute the necessary experiments, a committee was appointed, consisting of members of the Institute. The number originally selected, was twelve; to these two members have since been added, the committee being now composed of fourteen members.

The appeal of the Institute to the liberality of its patrons, was readily answered, and the subscription lists of the committee soon contained an amount subscribed, sufficient to warrant them in preparing for the experimental part of their labours.

There is perhaps no subject connected with the extensive branch of mechanics, for which theory has done so little, as for that which considers the effect of water upon wheels; the different theories* advanced are at variance with each other, and with practice, so that the candid theorist confesses that the circumstances, attending the action, are of so complicated a nature as to baffle his powers of investigation. Experiment, then, can alone guide to results worthy of confidence.

The experimental inquiries in relation to water-wheels which have, deservedly, attracted most attention, are those of Smeaton.† The means of a single individual could not be competent to prosecute such a subject upon the scale required to make the results entirely practical, and we find the ingenuity of Smeaton labouring against the difficulties incident to the contracted dimensions of the apparatus which he was obliged to employ, and arranging with great skill and resource the best means to render serviceable the working models which were used in his experiments.

The experiments of Bossut,‡ which rank next in extent to those of Smeaton, were comparatively few, and were principally made upon the undershot wheel.

It would not be profitable to enumerate the isolated experiments made in different countries upon this subject, since the sum of the information which they convey is extremely small. Of late years this branch of inquiry has been but little prosecuted, and the committee are not aware that any experiments, except a few in France,§ having in view a particular form of wheel, have been made, which tend to throw light upon the subject of their labours.

Such was the progress made in this subject when the Institute undertook it, with a view to obtain such results as should afford to the millwright a sure and safe guide in his practice, and thus contribute essentially to the promotion of one of the most important of the Mechanic Arts.

After frequent consultations of the committee, a plan of experiment was determined upon: the preparations of apparatus for executing this, occupied the autumn and part of the winter of 1829, and in the spring of 1830, the experiments were commenced. These occupied the committee until late in the following December, when the operations were finished for the season.

The committee consider that so little remains to be done to complete the proposed series of experiments, that they would not be justified in delaying their report, and that the results obtained should at once be placed before those to whose liberality the community are indebted for the opportunity of information upon this interesting subject.

It is hoped that means will not be withheld, by those who have not already contributed, to fill up the last subject upon the list of inquiries.

---

* Young's Analysis, or Gregory's Mechanics, vol. i. and 3d vol. American Philosophical Transactions.

† Smeaton's Experimental Inquiries, &c. (Taylor's Collection, 1794.)

‡ Détermination Générale de l'effet des roues mûes par le choc de l'eau, &c. 1769.

§ Poncelet, Mémoire sur la roue Hydraulique verticale à aubes courbes. Ann. de Chim. et Phys. (1825.)

One of the most important questions which arose for the discussion of the committee, was the measure of power expended, and of effect produced, to be adopted in their investigations. They finally determined upon one which, while strictly correct in principle, was at the same time, from its simplicity and ease of application, well adapted to their purposes, viz. for the measure of the power applied, the weight of water expended multiplied by the height of the head, (kept invariable,) above the bottom of the wheel; and for that of the effect, the weight raised multiplied by the distance through which it was raised. In order that this measure of effect may be accurate, the friction and inertia of the machine must be considered. The friction was carefully ascertained by experiment and the proper allowance made for it, as will appear in the course of this report. Any resistance from inertia was avoided by causing the wheel, and of course the weight raised by it, to move, before beginning an experiment, with a velocity which would remain constant during its progress.

The committee were very favourably circumstanced in relation to the power to be applied in their experiments, having, by the vote of the city councils, at command, a head of water fully equal to that which it was deemed necessary to employ. The greatest head used in any experiment was twenty-three feet.

The building to contain the apparatus, was erected upon a site, put at the disposal of the committee by Messrs. Rush and Muhlenburgh, which was of sufficient extent to enable them to make, to the best advantage, the various arrangements required by the undertaking.

In order that the experiments may be more easily understood, the committee preface the detailed account of them, by a general description of the apparatus used, and of the methods of experimenting. This description is accompanied by three plates, of which plates I. and II. represent side views, and Plate III. gives an end view of the apparatus employed. The drawings refer to the arrangements made for experiment with the largest wheel used, that of twenty feet in diameter; alterations were made, from time to time, to adapt the apparatus to the use of the smaller wheels. The principal parts are designated by the capital letters, the subordinate parts by the small letters.* When any of the less important parts are shown much in detail in one of the plates, they are not always exhibited on the others. A scale to which the drawings were made is attached to the first plate.

The principal parts of the apparatus were, the forebay, or reservoir, for containing the water to turn the wheel, the frame supporting the wheel, the reservoir in which was collected and measured by planking the interior of part of the frame just described; the sides and ends of the reservoir were carried to the height of six feet, and the floor was laid upon the cross-sills into which the uprights of the frame were tenanted.

---

* There are two kinds of small letters used, the *Italic* and the Roman, the small *Italic* letters are used until the whole number is exhausted, when recourse is had to the small Roman letters.

This reservoir having been formed accurately into a rectangular prism, its capacity was calculated by measuring the length, breadth, and depth: to test the accuracy of the result, the reservoir was filled, up to a certain level, with water carefully weighed, the number of pounds which the whole reservoir would contain calculated, and found to differ but 20 lbs. in 30,000, from the weight obtained by means of the capacity.

To indicate the level of the water in this reservoir, with a view to determine the quantity used in any experiment, a hollow tin vessel, *p*, *p′*, (Plate I.) was used as a float; a tube passed through the axis of the float, forming a stem, which was allowed to slide freely in a vertical direction upon an iron rod, or guide, attached to the bottom of the reservoir: the stem, *q*, *q′*, of the float extended to a convenient height above the lower floor, N, O, and was graduated into divisions, each of which represented a quantity of water within the reservoir of 1000 lbs. in weight. A light bar of iron, *r*, *r*,′ was attached to the upper timber of the wheel frame, having at its upper end, *r*, a loop embracing the stem of the float; to this loop was affixed a sliding plate of brass, *r*, *r″*, the edge of which could readily be placed opposite to that mark, on the float rod, which might happen to be next above the loop; this mark then served as a point from which to estimate the quantity of water used in any experiment without, before commencing, actually emptying the reservoir. The number of divisions on the stem of the float which had passed the top of the slide during an experiment, showed within certain limits of accuracy, the quantity of water which had entered the reservoir; but for greater nicety of determination, a gauge plate minutely divided was applied to the top of the slide, by the use of which the quantity of water in the reservoir could be obtained to within 5 lbs.

The water after leaving the wheel was conducted through a slightly inclined tail-race, U, R, to the reservoir. To prevent agitation of the surface of the water, within the reservoir, which would have resulted from the fall of water introduced from the tail-way, a flume R, *s*, *s′*, Q, (Plates I. II. and *s*, *s*, *s′*, *s′*, Plate III.) of a square section, was constructed, extending from the race nearly to the bottom of the reservoir, between which and the termination of the flume the water must necessarily pass; there was also a platform of light boards, nearly as large as the floor of the reservoir, placed within, which rose and fell with the surface of the water: these precautions so far preserved the float from oscillation, that the operator could obtain without delay by inspecting the gauge rod, the weight of water collected in the reservoir.

To empty the reservoir, a waste valve, *t*, (Plates II. and III.) was placed at one end; this valve could be opened by the lever, *t′*, *t″*; (Plate II.) having its fulcrum at *t‴*, acting upon the valve by the intervention of the rods, $t'\,t^{iv}$, $t^{v}\,t$, (Plate III.) and lever t^{iv}, t^{v}; it was raised above the floor so that the reservoir might never be entirely emptied, and that thus a level would always be afforded from which to reckon the quantity of water which entered during any experiment.

As only the water used in experiment was to be admitted to the reservoir, a valve u, u', (Plates I. II. and III.) 15 inches in breadth, and in length equal to the breadth of the wheel, was placed in the floor of the tail-race; this valve when open, allowed the water from the wheel to fall into a trough u, u, v, v', v'', v''', (Plate III.) which conducted it on the outside of the reservoir, by the trunk w, w', (Plates II. and III.) to the waste trough. Guide boards were placed in the tail-way on each side of the valve, that all the water might pass through it when open. The closing and opening of this valve were effected by the action upon the stem x, x', (Plates I. and III.) of a series of levers, (Plates III. and II.) x', x'', y, y', y'', z, connected by vertical rods x'', y, and y', y'', and terminating in the stem z, z', on the side of the forebay shown in Plate I.; by means of a handle, z'', attached to this stem the operator on the first floor, N, O, O′, was enabled to work the valve. When the valve was closed, the water flowed over it to the lower end of the tail-race, whence it passed, in the manner already described, to the reservoir. A bell, a, (Plate I.) attached by a spring to the stem z, z', ringing when the stem was moved, served to give notice of the closing or opening of the tail-way valve, that is of the beginning or end of an experiment. As in closing the valve, in commencing an experiment, the small quantity of water between it and the wheel, not used in the experiment, entered the reservoir, so on opening it, at the conclusion, an equivalent quantity of the water which had been used ran to waste.

The water carried up by the wheel when in motion, was returned to the tail-race by the guard, b, b′, u', (Plates I. II. and III.) placed for this purpose, and conducted to the reservoir, or allowed to run to waste according to the position of the valve.

Water-Wheel.

V, W, U, X, (Plate I.) represents the water-wheel used during the first series of experiments; this wheel was 20 feet in diameter, and 20 inches in breadth, being 16 inches, in the clear, between the rims, or cants. The rims were attached to the arms in the usual manner. The axis of 12 inches in diameter, into which the arms entered, was surrounded, for a certain portion of its length, as shown in Plate III., by a barreling of 24 inches in diameter, the gudgeons, 3½ inches in diameter, turning upon brass bearings, fitted into cast iron plumber blocks; the whole rested on the head blocks n, n', n'', n''', (Plates I. and II.) capable of sliding upon the upper beam of the frame supporting the wheel, by which arrangement the wheel might be removed from the breast when alterations were required.

On the inside of the head block, at n, Plate I., an iron pin was fixed, connecting two straps, also of iron, in the manner of a joint hinge; these straps embracing the barreling of the shaft had their ends, d and d′, connected by a wooden lever, d′, d″, turning upon a fulcrum, d‴, equi-distant from the ends which the lever connected; the pin forming the fulcrum passed through a post attached to one end of the head block: by depressing the end d″, of the lever, d′, d″, the straps were caused to press against the barrel with such force as to regulate, at the pleasure of the experimenter, the retrograde movement of the wheel produced by the descent of the weight which had been raised in any experiment; by elevating the same end of the lever, the straps were removed from contact with the barrel, which was thus permitted to revolve freely.

The buckets of the wheel having been varied in the different experiments will be described in detail in an after part of this report.

Apparatus relating to the Measure of Effect.

Y, Y′, Y″, and Z, Z′, Z″, (Plates I. and III.) represent two masts, or heavy posts, one of which was stepped upon the ends of two adjacent cross-sills of the forebay, at Y, the other, at Z, upon a strong piece of timber, bolted to the side of the frame, supporting the wheel. From the cap, Y″, Z″, (Plate III.) connecting these posts, were suspended two iron pedestals, e, e′, and f, f′, in which, in brass bearings, turned the gudgeons of a roller, or drum, e′, f′; the gudgeons were 1 inch and ⅞ths in diameter. The drum, 16½ inches in diameter, was covered with hoop iron, to prevent its abrasion by the chain which passed over it. The chain was attached at one end to the barreling of the shaft of the water wheel, and passing over the drum above, the other end, g, was fastened to a basket, g, g′, of iron in which were placed the various weights used in the experiments. To prevent inequality in the weight raised during any part of an experiment, from the winding of the chain upon the barrel, a similar chain, the lower part of which always rested on the ground, was fastened to the bottom of the basket.

The chain was kept from riding and chafing, as it wound upon the barrel, by depressing slightly the end f′, of the roller, thus giving the chain a tendency to move, in winding, towards the depressed end. The chain was brought back to its original position, at the higher end of the drum, during the descent of the basket, by inclining that part between the drum and barrel in an angle, to the axis of the drum, measured towards the elevated end, less than a right angle: to give this inclination a pulley, k, (Plates III. and I.) was fixed in an iron frame, k′, k″, capable of sliding in horizontal guide grooves; by drawing the frame towards l, the pulley was made to press against the chain effecting the object proposed. The iron frame, k′, k″, was drawn towards l, by a rope, one end of which was attached to the frame at k″, while the other passed over a fixed pulley, l, and was attached to an axle turned by the arms m, m′, and m, m″. The frame was carried back to the end, n, when the power ceased to be applied at the arms, m, m′, m, m″, by a weight n′, acting by the rope, n′, n, k′, passing over the pulley n, and attached to the frame at k′.

The measure of effect adopted was, as has been stated, the weight raised, and the height through which it was raised; to determine this height a mark was fixed to the chain at a point convenient for beginning the experiments, and a second to serve as a point of termination. To enable the operator to judge accurately of the arrival of these points on a level with his eye, an indicator, p, p′, p″, (Plate I,) being a miniature crane, was attached to the side of the forebay frame, the horizontal arm being placed at the proper height above the lower floor O, O′; the habitual position of the indicator was, as shown in Plate I, with the horizontal bar resting against the forebay frame. Just before the arrival of the lower mark upon the chain, at the level of the indicator, it was turned at right angles to the side of the forebay; when the mark reached the indicator, the stem, *z*, *z′*, of the lever for manœuvring the gate in the tail race, was raised into the position represented in the figures, ringing the bell *a*; the ringing of this bell, and the closing of the tail-way valve, being simultaneous, the precise instant was thus marked at which the water began to be admitted to the reservoir. On the arrival of the second mark at the indicator, the stem, *z*, *z′*, was drawn down, by means of the handle *z″*, again ringing the bell, and marking the time of the conclusion of the experiment, namely, that at which the water was allowed to run to waste by opening the valve in the tail-race: the stem, *z*, *z′*, was kept in its new position, by inserting the baton q, beneath the lower edge of the rest, q′, q″.

A very accurate time-piece, with the dial graduated to half seconds, completed the apparatus.

Method of Conducting the Experiments.

A general statement of the methods of experimenting will now be given.

One person was stationed upon the upper platform, specially charged with regulating the head of water in the forebay: this he did by means of the levers *d′*, *g*, and *e′*, *g′*, (Plate I,) controlling the stop cocks, *b*, and *b′*, in the supply pipes, or when the level was too high, by letting off as much water as was required to reduce it, through the waste valve *k*, Plate II; the head was ascertained by the float *h*, (Plate I,) tape line, *h*, *h′*, *h″*, and index, *i*, already described. The same person being always employed in this duty was, by practice, enabled to preserve a required head, subject to a variation of not more than a quarter of an inch, during any one experiment. The same operator opened and closed the gates for letting the water upon the wheel, and regulated the position of the chain during the descent of the basket so as to bring it back to the elevated end of the roller, by turning the arms m, m′ and m, m″, connected by the rope l′, l, k″, with the slide, k′, k″, carrying the pulley, k, (Plate III.)

A second assistant was placed upon the lower platform, N, O, O′, (Plate I,) who had in charge the regulation of the break or friction strap, and the closing or opening of the tail-race valve, *u*, *u′*, for collecting, or suffering to run to waste, the water used by the wheel; he also placed the proper weights in the basket, allowed the escape of the water from the reservoir when necessary, &c.

A third person attended to note the circumstances of each experiment, to observe the time occupied, the quantity of water in the reservoir as shown by the gauge rod, and to make the necessary calculations.

When an experiment was to be made, the moveable plate *r*, *r''*, (Plate I,) of the reservoir gauge was set to the mark on the gauge rod next above the loop. One of the gates for letting the water upon the wheel, was then opened, and the wheel suffered to revolve, with a full supply of water, until the basket was raised sixteen feet; by this time all the moving matter had acquired an equable motion, and the first mark upon the chain coincided with the indicator, p, p'; at this instant the second operator closed the tail-race valve, in doing which he rang the bell, a, the signal for the third operator to note the time. The first operator now carefully kept the water in the forebay, at a constant level. The water used by the wheel passed into the reservoir, R, S, T, Q, until the second mark on the chain, coincided with the indicator, when the second operator opened the tail-way valve, at the same time causing the bell, a, to ring, thus giving notice to the third operator to mark the time, and to the first to close the aperture admitting water to the wheel, and to stop the influx of water into the forebay. The chain was then drawn back, by the pulley and slide described, as the weight descended retarded by the friction strap. By the time the weight had arrived at the lower platform, the surface of the water within the reservoir was at rest, the amount there collected was ascertained, and a memorandum of it placed upon the minutes.

[TO BE CONTINUED.]

On the Causes of some Explosions of Steam Boilers. By THOMAS EARLE. *Read before the Franklin Institute, February* 24, 1831.

THERE have been several instances of explosions of steam engines, upon pumping additional water into the boilers, although the steam, before the addition of the water, had not shown a high expansive power. It is generally agreed, that immediately before these occurrences, the water has been very low in the boiler, the iron of the flue laid bare, and become very hot, and the steam also probably heated to an unusually high degree. But a doubt has arisen whether the heat that produces the great excess of steam, which causes the explosion, is borrowed from the hot iron, or from the hot steam previously in the boiler. The object of this paper is to endeavour to do something towards settling this question.

Question 1. If heat be borrowed from steam at a high temperature, to convert additional water into steam at a lower temperature, will the whole quantity of steam thus obtained possess more elastic force under a given volume, than belonged to the hot steam alone?

It is an ascertained law of steam and of all gases, that equal additions of temperature, give nearly equal additions of volume. It is also ascertained that gases and steam for each degree of heat they re-

PLATE I.

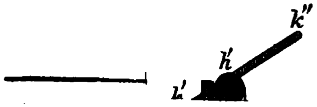
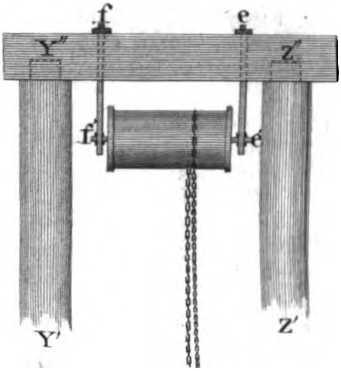


PLATE III.



ceive, gain about $\frac{1}{480}$ of the volume they occupied at 32° Fahrenheit. This would give a gain of $\frac{1}{660}$ of the volume occupied at 212°, for each additional degree of heat above that point. Hence, an addition of 660 degrees of heat, should increase one volume of steam, at 212, to two volumes, under the same pressure, or should double its power.

Then if we have water at 212, and to 1 gallon, add 960 degrees of heat, we get about 1700 gallons of steam, under atmospheric pressure: then put 960 degrees more of heat and another gallon of water, we increase the steam to 3400 gallons: whereas if, in the last case, we had added the heat to the steam already made, 663 degrees would have sufficed to increase the steam to 3400 gallons. Thus 960 + 960 = 1920 degrees of heat, in the first case produced no more effect, than 960 + 663 = 1623 degrees do in the latter Heat added to steam *already formed*, is, therefore, more effective than the same quantity of heat added to hot water: and the theory of explosions from water converted into steam, by heat borrowed from other steam, cannot be true, unless the specific heat of steam be much greater than that of water, under equal weights; or, in other words, unless it takes a much greater absolute quantity of caloric to raise a pound of steam one degree, than it does to raise a pound of water one degree.

Dr. Crawford, from his experiments, inferred that the specific heat of steam was 50 per cent. greater than that of water. If this were correct, the effect of a certain quantity of caloric added to steam, or added to hot water, would be just about equal. But the more recent, and generally believed more correct experiments, of Delaroche and Berard, give a greater specific heat to water than to steam, in the proportion of 1,000 to 0,847. From this it would result, that heat added to steam, produces nearly double the effect which it would have done, if employed to generate more steam. On the whole, assuming as correct either Mr. Crawford's conclusions, or those of Delaroche and Berard, explosions cannot be produced by pumping even water at 212 degrees into highly heated steam, without the aid of some other cause.

Question 2. Can explosions be produced by pumping water on red hot iron?

The specific gravity of iron compared with water is as 7.788 to 1,000, say as 8 to 1; and the specific heat of hot iron compared with water under equal weights is as 0.1255 to 1: say as 1 to 8.* It takes about 8 times as much caloric, to heat a pound of water one degree, as to heat a pound of iron one degree: but about equal quantites to heat a given *measure*, say one cubic inch, of each substance. Consequently a cubic inch of iron at 300 degrees, on being reduced to 250 degrees, parts with nearly 1700 times as much heat, as a cubic inch of steam at 300, reduced to the same degree: and a cubic inch of red hot iron at 1172 degrees, has heat enough to convert one cubic inch of water into 1700 cubic inches of steam.

---

* Some experiments tend to show the specific heat of iron, compared with that of an equal weight of water, to be as 1 to 9. The difference, however, is entirely immaterial to the purposes of this essay.

Hence it appears extremely easy to produce explosions from throwing water on hot iron, as indeed is proved by Perkins' steam gun. If that gentleman's generators had been no stronger than ordinary boilers, they would have been destroyed by one-third of the power which he produced by throwing water on their red hot iron: and strong even as they were, they would have exploded had he pumped in a sufficient quantity of water, without giving vent to the steam produced.

A cubic foot of hot iron by being reduced to 32 degrees, would furnish heat sufficient to convert a cubic foot of ice cold water into 13,600 gallons of steam, at atmospheric pressure: and a single square foot of boiler-iron, $\frac{5}{16}$ of an inch thick, if only at a bright red heat, has caloric enough to make 88 gallons of steam. It is probably not very uncommon for boilers to become so destitute of water, that 10 or 15 square feet become red hot. This surface, by losing only half its heat, would produce steam enough in addition to that already existing, to explode almost any boiler.

The sudden cooling of a part of the boiler, no doubt weakens it very much, and hence we find some boilers in their rupture following the water line, which line was probably made by a fresh supply of water, or by a motion of the steam boat raising the water upon the heated iron of one side.

The explosions which have occurred about the period of coming to, or leaving a wharf, may be attributed to the boat's being thrown partly on one side, either in turning, in striking the wharf, or under the weight of passengers shifting their position, so that the water is thrown upon hot iron of the boiler.

The conclusion to which I come, is, that a considerable proportion of the explosions which occur, is occasioned by water being thrown on highly heated iron. The proper preventives, are, care in engineers, and such construction of boilers, that the part exposed to the greatest heat will not be soonest laid bare, nor a large surface either suddenly laid bare, or suddenly covered by water: also to throw the water into the bottom of the boiler, rather than by a jet into the upper part.

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, February 24, 1831.

Thomas Fletcher, vice president, in the chair.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Mr. A. B. Hutton.

The Mechanics' Journal, or Artisans' Miscellany of Inventions, Experiments, Projects, and Improvements in the useful Arts.

By Mr. Zachariah Allen.

The Science of Mechanics as applied to the present improvements in the useful Arts in Europe and in the United States.

By Mr. Josiah Copley.

Letter from the Secretary of the Treasury, transmitting the information required by the House of Representatives in relation to the growth and manufacture of Silk, adapted to the different parts of the Union.

By the Board of Managers of the Institute, for 1830.

Précis, Elémentaire de Physique Expérementale, par J. Biot, Vols. 1 *and* 2.

By Professor A. D. Bache.

Catalogue of the Officers and Students of the University of Pennsylvania, January, 1831.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute, viz.

The Mechanics' Magazine, and Journal of Public Internal Improvements, for January, 2 *copies.*

Journal of the Philadelphia College of Pharmacy, for January.

American Annals of Education and Instruction, and Journal of Literary Institutions, for February.

The Magazine of Useful and Entertaining Knowledge, for January.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, for August, 1830.

Professor A. D. Bache stated, on the part of the committee on explosions of steam boilers, that the preparatory arrangements for experiments had been made, and apparatus for further prosecuting the objects of their appointment was in progress.

Professor Johnson from the same committee stated, that the committee had taken measures to obtain specimens of American iron for the purpose of experimenting on the strength of the different kinds of that material employed in the formation of steam boilers.

Mr. D. H. Mason made some remarks on the application of the power of steam engines to locomotive carriages.

Thomas Earle, Esq. read a paper "on the causes of some Explosions of Steam Boilers," which, after some remarks, was referred to the committee on publications.

The following queries were proposed for discussion, and ordered to be entered on the minutes.

1st. The subject of rapid and slow motions of boats in abrading the banks of a canal.

2nd. What are the relative advantages of stationary and locomotive power, in propelling carriages on planes of any elevation?

3d. What are the best means of securing the boilers, cylinders, and all other parts of steam engines, whether employed for stationary purposes, for navigation, or for locomotive carriages, against loss of power by radiation and conduction?

THOMAS FLETCHER, *Vice President.*

J. H. BULKLEY, *Recording Secretary.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1830.

With Remarks and Exemplifications, by the Editor.

(Concluded from page 84.)

14. For machinery for ***Planting and Digging Potatoes***, and for ploughing corn, potatoes and other plants; Phineas Meigs, and Matthew C. Arnold, Madison, New Haven county, Connecticut, November 3.

The machine which serves as the foundation of the different operations, is framed together much in the manner of a common plough. There are various distinct parts, which are capable of being attached or removed at pleasure. Thus a double or single mould board may be used. A kind of harrow, may be attached to the beam behind the mould board, to collect the potatoes; and several other contrivances are represented in the drawing, some of which, we doubt not, may be advantageously employed. The whole is clearly explained, and distinctly represented in the drawings. The claim is to the construction of the machine as described, which is capable, by changing its parts, of performing the different purposes specified; the mode of combining and fastening the different parts; and the application of steel plates, and nose pieces, which may be renewed at pleasure.

---

15. For *Combined Spiral Springs, for Clocks;* Silas B. Terry, Plymouth, Litchfield county, Connecticut, November 3.

The object of this invention is to combine several spiral springs together, in such a way, that a clock when wound shall run three or four times as long as with a single spring.

The patentee says, "instead of a single spiral spring, such as is commonly used for spring clocks, or time pieces, I employ two, three, four, or more, such springs, but made narrower than those which are usually employed; so that two, three, or more, need not collectively be wider than the common clock spring.

"I sometimes enclose each spring in a barrel, resembling the barrel usually employed, but only of sufficient depth to receive the spring. Such barrels and springs may be connected with each other, and made to act in combination.

"Instead of forming a barrel, I sometimes use a circular plate, having near its periphery a number of projecting pins. These projecting pins answer the purposes of the rim in the barrel, as they retain the spring in its place, and one of them serves to fasten its outer end, by merely giving it a turn, that it may slip over one of the pins. A circular piece is fastened on the opposite side of this plate, to receive the inner end of a spring.

"Upon this plan, such a number of springs may be added as shall give the desired number of turns, and a wheel and pinion be saved in the construction of a time piece.

"From the great length of spring afforded by this combination, a uniformity of action is secured, which will cause a time piece to which it is applied, to act with greater regularity without a fusee, than is possible with the ordinary spring; whilst from its great flexibility, the spring is less liable to break, or to fail in any way.

"What I claim as my invention, and for which I ask a patent, is the combining, or connecting together, a number of spiral springs, upon the principle, and for the purposes herein before described."

---

16. For a machine for *Washing Gold;* Daniel Jones, Granville county, North Carolina, November 3.

The mode of agitating the earth to be washed, and of supplying a stream of water to effect the object, is very similar to methods which we have before described; the patentee does not tell us in what his invention consists, or make any claim to any part of the machinery.

---

17. For a *Machine for Scraping the Flesh and Hair from Hides and Skins, and Dressing the same;* Thomas Williams, Rochester, Monroe county, New York, November 4.

(See specification.)

---

18. For an *Inking Apparatus,* being an improvement on the inking apparatus of 'Neal's Vertical Printing Press,' and applying the same to other presses; Rich Wood, City of New York, November 4.

(See specification.)

---

19. For an improvement in the *Cotton Press;* Joseph Carson, Raleigh, North Carolina, November 4.

The press here described is a rack and pinion press, so arranged as to be conveniently employed in the pressing of cotton.

The shaft of the pinion is vertical, and a braced beam extends horizontally from it, to move it by horse or other power. The lever must be of such length, as to enable the horse to walk clear of the frame work of the press. A stout piece of timber, provided with teeth, form the rack, and forces up the follower against the cotton. The mode of framing, and the appurtenances for forming the bales with convenience, do not differ from those previously used in other cotton presses.

The whole machinery is described, but no claim made. We are not aware, that, in the present instance, the omission is of any importance.

20. For a *Washing Machine;* Gideon Lowell, Nunda, Alleghany county, New York, November 6.

This, like numerous other washing machines, has a cylinder, the periphery of which consists of circular rollers; the gudgeons of this cylinder rest upon the edges of a trough. The article to be washed is placed between the cylinder, and circular rollers crossing the trough. Springs are used to regulate the pressure. The cylinder is to receive a vibratory motion.

The patentee tells us, that "the improvement claimed *on* the above described machine is the whole, except the box or sink, and that made 2 inches wider, which is a great advantage in washing large clothes." We do not know whether or not it is intended to claim the two inches; perhaps, however, it will be best to do so, as they will distinguish this machine from others, as clearly as its other novelties.

21. For a *Machine for Thrashing Grain and Clover Seed;* James Darrah, Corkstown, and Jacob Kinsey, Ruscomb-manor, Bucks county, Pennsylvania, November 6.

The cylindrical beaters are in the common form, fluted upon their edges. The hollow segment consists of rollers of cast or wrought iron, turning on pivots, and the bars twisted in reversed directions. A simple fluted bed is to be used for clover seed.

"The *Invention* here claimed, is the double frame, to enable the cylinder to run in three boxes." That is, the shaft of the cylinder has three bearings, one on each side of the wheel by which it is to be turned, and one at the opposite end. "The bead in the boxes with the corresponding groove in the spindle." The common plan of a fillet on one of the boxes, and a groove in the spindle, operating like the swell on a grindstone spindle, is here intended; for although not mentioned in the description, this fillet appears in the drawing.

"The screw rollers and side plates, with the bolts and spiral springs. The additional roller in the feeding apparatus, and the fluted bed to be used for clover seed."

It is one of the most difficult points in a specification, even where a machine possesses much of novelty, to "distinguish the same from all other things heretofore known or used." This difficulty must necessarily increase with the want of originality in a machine, but even in such a case it may be as well to say little or nothing about it, and it certainly would be prudent to avoid claiming as new, what every tyro in mechanics knows to be far older than himself.

22. For a mode of *Uniting Timber in Building Domes, Bridges, &c.;* William Annesley, Albany, New York, Nov. 6.
(See specification.)

23. For improvements in the *Mode of Building Vessels;* William Annesley, Albany, New York, November 6.
(See specification.)

25. For an improved labour-saving *Tanning Apparatus;* William Brown, City of New York, November 11.
(See specification.)

---

26. For an improvement in the *Power Loom;* John Standish, Belfont, Providence county, Rhode Island, November 11.

"My improvement in weaving consists in pressing the cloth beam against the yarn beam, by levers, as is clearly explained in the drawing annexed, fully complying with the requisitions of the patent act. The advantage resulting from my improvement, is in consequence of the two beams revolving with equal motion. As the yarn is discharged from the yarn beam, the cloth is wound upon the cloth beam with an equal, steady motion; avoiding the inequalities in the cloth as woven in the usual method."

The foregoing sententious paragraph, comprehends nearly the whole of the specification. In it is contained the description of the machine, an account of its utility, and a decision that the patent law has been fully complied with. We hope for the sake of the patentee, that the plan may be found to be new, useful, and profitable.

The arrangement is well represented in the drawing. The gudgeons of the cloth beam run in moveable uprights, connected together by a bar, and are operated upon by a weighted lever. No machinist would be at a loss in carrying the plan into operation, the simple idea being once given.

---

27. For an improvement in the *Temple of the Common Power Loom;* John Standish, Belfont, Providence county, Rhode Island, November 11.

The specification of the temple is about as short as that of the power loom; it refers, however, throughout, to the drawings which accompany it; these are so wretchedly executed, that we could not undertake the task of deciphering them.

---

28. For improved *Fire Engines;* John James Giraud, Baltimore, Maryland, November 11.

We have more than once met with Mr. Giraud, in our visits among the patentees, and we recollect that his anticipations are always of an elevated character. In the case in hand he has taken care not to fall below his ordinary level. In his peroration the patentee informs us that by his "improvements in hydraulics and fire engines, water may be thrown double the distance as is accomplished at present, and with very little power."

The description then informs us that two cylinders, each with caps or domes, are to be placed one within the other, a space of an inch being left between each; but as one of the cylinders is to be six, and the other five inches in diameter, we should have looked for only half an inch of space between the two. The inner cylinder is to be suspended within the outer, and its lower edge is not to reach to the bottom, as it is to operate as an air chamber. The lower end of the outer cylinder is to be closed by soldering a bottom on to it. The particular form of some of the parts cannot be given without a drawing, and this we do not think the occasion justifies. The part which we have described operates simply as the common air vessel. Two openings are to be left in the bottom of this vessel, which are to be covered with valves. Two forcing pumps constructed in the manner of those used in other fire engines are to force the water into the air vessel. A pipe to receive the goose neck, passes through the domes or caps, of the two first described cylinders.

We now quote the patentee.

"Upon the same principle may be constructed a great reservoir for atmospheric air, and to raise water of itself to a certain height, by pressing this air by means of a pump of a suitable construction, with weights attached to the piston to produce a pressure calculated to raise the water to a given elevation.

"I claim my principle as here described, not only to convey water, but also with the same mechanical means, fire and steam, fluids of every description, gases, &c. single or compounded. I also claim my principle applied in any manner whatsoever, to machinery of every and all descriptions. J. J. GIRAUD."

---

29. For an instrument for *Stemming of Dry Tobacco;* Germain Bréant, City of Richmond, Virginia, November 11.

A strip of steel about eight inches long is fixed upright upon a table. Through this strip there are three holes of different sizes; the stem is to be drawn through one of these holes, when its sharp edge will strip the leaf from the stem. The strips, the patentee says, are much more perfect than those obtained by hand. The quantity of leaf is greater, and a new hand can perform the work with the same facility as an adept.

---

30. For a *Rotary Straw Cutter;* Samuel Wilson, Darlington District, South Carolina, November 11.

A solid wheel is made to turn by a crank, in the manner of a grind stone. On the flat face of the wheel, on the side opposite to the crank, is fixed three, or any other number of cutters, in the direction of radii of the wheel; these steel cutters stand out from the face of the wheel, at a distance equal to the length of the intended cut straw. The straw is placed in a trough, and is to be fed to the cutters by hand or otherwise. The claim is as follows.

"What I claim as new in this invention, is the arrangement of the cutters on the face of the solid wheel, in the direction of the radii of the wheel, and at a distance from the face of the wheel, equal to the required length of the cut straw. I further claim as new, the iron, or steel fixture on the reversed face of the wheel, nearly opposite each other, and rubbing against the iron fixture in the frame, which prevents the wheel and the cutters springing from the fixed plate, which forms a part of the shear, or cutter."

Where the straw is fed by hand, the solid wheel offers some advantage, but where it is fed by rollers, as in numerous straw cutters, it affords none. The cutters forming radii to the wheel, is far from being an improvement upon those which are curved, or which form an angle with the radii. The general structure of this machine seems to us to possess no just claim to novelty.

---

31. For an improvement in the manner of *Covering the Roofs of Houses with Plates of Tin,* Copper or Zinc; Peter N. Ware, Albemarle county, Virginia, November 11.

"The said improvement consists in locking, or grooving the sheets together at the bottom, as well as on the sides, and securing each sheet as it is put on, with hooks of the same metal, at top, and on the side; the hooks being nailed on to the sheeting plank. The advantages are evident, as not a single nail passes through any one sheet of the entire roof, except on the outer edges. The locking at bottom prevents the draft of air which causes leaks."

The foregoing is the whole of the specification. The patentee is mistaken in supposing, that the grooving of the sides and bottoms of such plates, is a new invention.

---

32. For a *Self Tightening Sacking Bottom Cot Bedstead;* Peregrine Williamson, City of New York, November 11.

There seems to be a little too much complexity about this self tightening cot. A description of it would not be very intelligible without a drawing; and we pass over many things to which we would more willingly afford one. If the invention possesses a moiety of the virtues ascribed to it, it is a very good thing. The claims are not few in number, and, we think, not all original; among them are, the application of a mortise in the legs, which mortices are slots, allowing the pin of the stretcher, which extends from one pair of legs to the others, to slide in them; the application of rails inserted into the head and foot boards, so as to revolve on their axes; the application of wheels to the feet; the supporting bar, with the piston rod attached; the application of a stretcher to the centre of the legs; the lever fastening; the application of slots, and also detachable woven cord bottoms to cots, &c. &c.

We have frequently seen stretchers to the legs, and detachable bottoms, attached to the rails by pins, as shown in the drawing. If there is any thing new in the mode of applying them by the present patentee, we do not understand his description.

---

33. For an *Apparatus for Holding Tow Lines,* and for other purposes; Robert Davis, Philadelphia, Pennsylvania, Nov. 11.

This apparatus is a kind of double lever, working upon a pin something like a pair of shears, a spring operates to close the ends which are to hold the tow line; these ends have a cavity through which the line passes. When, to prevent accident, it becomes necessary to detach the tow line, the upper lever is to be pressed down, and the line liberated. The apparatus appears to be simple, but it is not clearly described.

---

34. For an improvement in *Cider Mills;* Charles Rice, Barre, Worcester county, Massachusetts, November 11.

This cider mill and press are placed upon wheels, to move them from place to place. There is a sweep, attached to an upright shaft, to be turned by horse power. The apples are put into a hopper, at the lower part of which is a cylinder with teeth, by the revolution of which they are ground. The pommage falls into a square or circular rack, or cage, in which it is to be pressed. At the bottom of this cage there is a follower, which may be drawn up by two screws, the cider then runs down into a trough below.

"The *invention here claimed,* and for which a patent is desired, is the press; the rack; and the arrangement of the different parts of the mill as before described."

This claim we think much too indefinite, as there are other patented cider mills in which some of the arrangements are essentially the same with the present.

---

35. For an improved *Cloth Mangle;* Thomas Rundle, Boston, Massachusetts, November 11.

In this machine, the mangling is to be performed between cylinders, without a traversing box. The method of making the whole is illustrated by drawings, referred to throughout. The admeasurement of the different parts is given with minuteness, but we are not told in what the novelty of the machine consists, nothing appearing in the form of a claim. The use of rollers, pressed together, instead of a loaded box, is certainly not new, yet according to the tenor of the specification, the whole machine must be considered as claimed.

---

36. For an improvement in the *Lathe* for shaping various articles of irregular form, according to a pattern; Elias Rhodes, Kingsbury, Washington county, New York, November 11.

The specification commences by informing us that the "species of lathe to which this improvement is applicable, has been in use for a number of years past, for the shaping of gun stocks, and other articles of irregular figure according to a pattern of the article to be formed. The general principle of its operation is well understood, and will therefore require but a brief description."

After giving this brief description, it is said,

"What I claim is the application of one or more circular saws to the above described lathe, for the purpose of shaping axe helves, wagon spokes, or any other article which may be shaped therein, excepting lasts and hat blocks."

This is rather a curious kind of claim, and one which is based upon a common, but very mistaken notion. The patentee does not pretend to have invented the machine, and excepts lasts and hat blocks from his claim, because they are made in a similar lathe. It has been decided in court, and the decision rests upon the plain dictates of common sense, that to apply an old machine to a new purpose, is not an invention, or discovery, for which a patent can be sustained.

---

37. For an improvement in *Spinning Cotton Yarn, &c.* being improvements in his running cap spinner, &c.; John Thorp, Providence, Rhode Island, November 11.

The specification of this patent was published in our last volume, page 288.

---

38. For an improvement in the machine for *Thrashing Grain and Hulling Clover Seed;* Leuman Cooley, City of Philadelphia, November 11.

This thrashing machine differs not, in its general structure, from the great family of that name. The beaters are not to run in a straight line from one end of the cylinder to the other, but are to be bent in curves, or to form angles, that they may strike the grain obliquely. The claim is to "the angular, or curved beaters, they having a tendency to spread the grain equally over the cylinder, before coming in contact with the concave bed, and also preventing the whole length of the beater from striking the grain at the same time, and causing less friction."

"Placing of the concave half circle, or bed, round the end of the machine, which admits a much greater concave than can be obtained in any other way; consequently the cylinder may be placed at a greater distance from the concave bed, thereby admitting a larger quantity of grain, as the cylinder has a more extended space to act upon it. It also separates at the same time the grain from the straw."

---

39. For a *Combined Plough;* Samuel Cline, New Britain, Bucks county, Pennsylvania, November 12.

This combined plough is intended for ploughing in light, free soils. There is a beam with handles attached in the usual manner; the ploughs, however, are not fixed to this, but to a second beam which crosses it at an angle of 45 degrees. To the transverse beam it is proposed to affix five ploughs; the centre one standing at the point where the transverse is attached to the ordinary, or longitudinal beam. This may be called the centre plough. The transverse beam is about 5 feet in length, the ploughs placed about 14 inches apart, causing them to cut about ten inches each. The ploughs consist simply of a mould board, landside, and sheath, or standard. The mould board is drawn and flattened out so as to supply the place of a share. The sole of the plough is not much to exceed its extreme breadth. Ten inches in length, and eight in breadth, it is said, has been found to answer perfectly well.

"Two horses are able to work this combined plough quite easily, and to pass over as much land in a day as three teams of two horses with the common single plough." So avers the patentee.

---

40. For an improved *Fire Proof Chest;* John Scott, City of Philadelphia, November 12.

The patentee claims to have made various improvements in the fire proof chest, and in doing so we are more than apprehensive, that he has included things which are without the shadow of novelty. We give the first as an example.

"Sec. 1. I improve the incombustibility of the wood used, by steeping it in a composition of water with salt, and pot and pearl ashes; the precise proportion of each not being material. The use of the pot and pearl ashes in this way, and for this purpose, instead of common wood ashes, constitutes this portion of my improvement."

Now there is just as much difference between the ley from common wood ashes, and a solution of pot and pearl ashes, as there is between brine and salt and water, potashes consisting entirely of the saline matter which is left after evaporating the water from common ley. There is no novelty in this application.

The second improvement consists in covering the wood with a coat of glue and emery.

The third in making drawers of tin, instead of wood.

The fourth is in the form of the castor, which consists in making some parts of it rounding which have *sometimes* been made flat.

There are in the whole ten sections, each referring to a particular improvement, so called, and some of them probably deserving the name; but in taking out a patent, if a new piece is put upon an old garment, the rent is made worse, by at least thirty dollars.

---

41. For a mode or manner of *Supplying the Boilers of Steam Engines with water;* John S. Williams, Maysville, Mason county, Kentucky, November 17.

(See specification.)

---

42. For an improvement in *Monuments, Memento Plates, Statues, and Mantel Pieces,* by the application of cast iron instead of stone or wood; Henry Libeneau, City of New York, November 17.

This patent is taken for making the foregoing articles of cast iron. In the specification we meet with calculations of the relative cost of cast iron and stone, and have an essay upon the subject rather than a description of what the patentee has invented. There is no claim made, and the whole, therefore, is patented. We have no confidence in the validity of such a patent; or rather we feel confident that it is altogether invalid. Cast iron mantels, and, indeed, articles of almost every description to which this material is applicable, are made in England, and have been in use for many years.

---

43. For a machine for *Raising Mud, Sand, or Gravel, from the Beds of Streams, Rivers, and Harbours;* Elisha H. Holmes, Norwich, New London county, Connecticut, November 18.

The general structure of this machine is similar to some of those now in use for the same purpose. The patentee says, "some of the advantages gained by my improvements, are the facility and despatch with which the machine is operated. Heretofore the shovel has been brought back by hand, by a crank on the stern of the boat, whereas it is now brought back by the horses, or whatever other power may be applied."

---

44. For a method of *Ornamenting Horn and Tortoise Shell Combs,* so as to resemble carved work; Maulby J. Littleboy, City of Philadelphia, November 19.

This patent is obtained for pressing tortoise shell and horn combs in dies, by the aid of heat. Combs so ornamented have been imported in great numbers from India. This mode of ornamenting articles made of these materials is one of the best known processes in the mechanic arts; still the patentee claims "the method of putting an ornament, or impression, upon horn and tortoise shell combs, so as to resemble carved work, by dies, heat, and pressure."

---

45. For a *Kitchen Grate;* Levi Disbrow, City of New York, November 22.

This, which the inventor calls the JACKSON GRATE, is for burning anthracite coal, and is made exactly like the grates most commonly used for that purpose, but of greater length. To regulate the size of the fire he uses partitions of iron which are moveable, and extend from the front to the back of the grate. We are told that there may be an oven attached, if required, and that the crane should be strong enough to bear what is hung on it, which is certainly very proper. "The patent is not claimed on the grate alone, but as to the manner of applying it to use." This is all that appears in the form of a claim, and as we do not clearly understand what is meant by it, we leave it to the judgment of our readers.

---

46. For a machine for *Washing of Clothes,* scouring of yarn, &c.; J. Tenny, New Woodstock, Madison county, New York, November 23.

A swing frame with a roller at the bottom of it, is made to vibrate by hand; the clothes are placed in a trough with a bed piece of suitable curvature.

There is no claim, and as similar machines have been long since patented, tried, and abandoned, we apprehend that the want of a claim will not be a source of loss.

---

47. For a machine for *Hulling Clover Seed, Rice, &c.;* William Manning, Westfield, Essex county, New Jersey, Nov. 24.

The invention claimed is "the mode of hulling clover seed, rice, barley, and other small grain, by the revolution of a cylinder in a curved hollow bed, covered with wire, or other teeth."

We know of no method more commonly adopted than that of hulling by a cylinder set with teeth, and working in a concave bed, it is probable, therefore, that this machine, if well made, may, in one respect, fulfil the anticipations of the patentee; we were going to say of the inventor, but he, undoubtedly, has "passed the bourne."

---

48. For an improvement in *Clocks and Time Pieces;* Jacob D. Custer, Norristown, Montgomery county, Pennsylvania, November 24.

The specification of this patent is by no means a description. A drawing accompanies it, but this is without written references. A model is referred to throughout, which model is in the patent office, and is incapable of publication.

This mode of procedure is altogether incorrect, and insufficient. The model is a mere contingency, and it is requisite that the invention should be made fully known without any reference to it.

What appears in the form of a claim we will copy, although it will afford but little light respecting the nature of the thing patented.

"The following are the parts improved, which your petitioner claims. The whole of the moving works except the weights and line. And the whole of the striking and alarm works except the barrel wheel and its line and weight. And the piece that comes out through the dial, at the left side, to set it to strike, or strike and alarm, or alarm only, or neither strike nor alarm. And the main wheel, and the date wheel, and the case. And the fly wheel and verge, or pendulum and verge, or scales and verge, to regulate the stroke. And the hammer with a spring as common clocks. And the bell on the top as in common clocks. And the time piece the same as the moving works of this model. And the application of those striking, or alarm works to watches. And the application of those striking or alarm, or moving works to clocks made in the common way, and wooden clocks made after this plan."

JACOB D. CUSTER.

The foregoing claimer, and disclaimer, is a fair sample of the clearness, or rather of the ambiguity, of five closely written pages of description. Those who do not understand the thing from the foregoing, are referred to the model room at the patent office.

---

49. For a *Thrashing Machine;* Alonzo S. Smith, Brutus, Cayuga county, New York, November 24.

The usual cylinder with teeth, and a hollow segment form the operative parts of this machine. There is a long list of claims for the particular mode of forming and arranging certain parts, but we do not see in it any thing particularly worthy of notice.

---

50. For an improvement in the *Machine for Dressing Hemp and Flax;* Joel Dewey, jr. Troy, Rensellaer county, New York, November 25.

This machine is much less complex than most of those used for flax dressing; and this would be no small praise, provided it was equal to them in operation. It appears to us, however, to be an improvement somewhat like those which have been proposed in the steam engine, by individuals unacquainted with its history, who have gone a hundred years back, and patented Capt. Savary's over again.

The patentee uses what he calls a swingling cylinder. This consists of four arms, each carrying a wooden knife. The hemp or flax is to be allowed to hang over a bar, or hanging piece, in such a way that the knives may operate upon it. There are, altogether, *two* fluted rollers between which the hemp, or flax, is to be passed. The lower is to be pressed against the upper roller by a weighted lever, or bar, in a well known manner. The claim is "the way of making the fluted rollers. The manner of weighting and graduating said rollers; also the manner of constructing the swingling cylinder, and hanging piece to swingle over."

What is the particular "way of making the fluted rollers," we are not told; and in fact, the whole machine is very imperfectly described, and badly represented in the drawing.

---

51. For an improvement in the art of *Manufacturing all kinds of Bottles, Decanters, and other pressed hollow Glassware, with the* neck or apertures smaller than the cavity or inside diameter of the vessel; John M'Gann, Kensington, Philadelphia county, Pennsylvania, November 26.

When a decanter, or similar vessel, is to be made, there are to be two moulds, with their proper presses. In one mould the lower part of the decanter is formed, in the other, the upper part and neck. One of the moulds is fixed to a hinge in such a way, that when the cores of the two parts are withdrawn, one mould will turn over upon the other, and bring the edges of the glass into exact contact, when, by a slight pressure, they are made to adhere; the moulds are then opened, and the decanter removed from it.

The claim is to that construction of the cores and moulds which enables the operator to form vessels of glass, in the way above described.

---

52. For an instrument for *Cutting Channels for Seams, in the Soles of Boots and Shoes;* James Cole, East Bloomfield, Ontario county, New York, November 26.

This instrument consists of a knife which projects from the end of a piece, or pieces, of wood, formed in the manner of the shoulder piece, used by shoemakers.

The knife has a slot in it, and is fixed by means of a screw, allowing it to be set so as to cut to a greater or less depth. The claim is to the construction and use of such an instrument.

53. For an improvement in the *Mode of Combining Printing Types for Music;* George Bruce, city of New York, November 27.

(See specification.)

54. For a *Fan moved by Mechanism, for bed chambers, dining rooms, halls, &c.;* James Barron, Norfolk, Norfolk county, Virginia, November 27.

Four wheels and four pinions are to be fixed in a suitable frame. A barrel, like a clock barrel, with a weight and line attached to it, is to be wound up to keep the fan in motion. It is so calculated as to run about eight hours. A crank upon the shaft of the last pinion, gives motion to a rod, which is to vibrate like a pendulum rod; upon the end of this rod the fan is placed.

"The improvement here claimed is the above described machine for fanning bed chambers, dining rooms, halls," &c.

The foregoing is certainly a very complex mode of attaining the proposed object. We should find no difficulty in making a much more simple instrument for the purpose, and which certainly would not interfere with the claim to "the above described machine."

55. For a *Thrashing Machine;* Samuel Turner, and Norris Barnes, Aurelius, Cayuga county, New York, November 27.

Another cylinder, and another hollow segment, are united together, and these twain, as heretofore, form one thrashing machine. The segment is to be of cast iron and fluted, the beaters are to be formed of square bars of wrought iron, and twisted, and "the particulars which the petitioners claim as their invention and improvement, are the reeded and fluted bed for the cylinder; and the peculiar position and construction of the Beaters on the cylinders. But they claim the right of every modification of said improvement, which is consistent with the principle of the same as herein described and specified."

There have been so many *modifications* of the same *principle*, previously patented, that the acquiescence of certain individuals in the claim here set up, is a point which verily admits of some doubt.

56. For a *Thrashing Machine,* called Flagg's Rotary Thrashing Machine; David Flagg, jr. City of New York, November 29.

There are two, or more, cylinders with rows of teeth upon them;

the teeth of one cylinder being made to pass in the spaces between the teeth of its antagonist. We are told, however, that a hollow bed with teeth, may, in some cases, be substituted for one of the rollers.

The claim is to "the manner and form in which the cylinders operate together, as above described, for the aforesaid purposes."

---

57. For a *Rotary Steam Engine and Boiler;* Caleb Tompkins, Montgomery, Montgomery county, Alabama, November 30.

The history of rotary steam engines, is a history of failures, in which much talent and money have been spent, and, hitherto, to no good purpose; many of the best practical engineers are now satisfied that the rotary will never supersede the reciprocating engine. The engine described by the present patentee, does not afford any thing new in principle, and its details are so imperfectly described, and so obscurely represented in the drawings, that it offers nothing to justify an augury in its favour. There is no claim made to any part. The anticipations of the patentee are, as is frequently the case, of a character somewhat too magnificent; they are manifestly theoretical, as we are very certain that a practical essay would have subtracted much from the sum entered on the credit side.

The boiler described is 3 feet in diameter, and 10 feet in length, and we are told that "this engine is capable of producing 200 horse power, as is calculated at present, and can be practically used in all cases where steam power may be required, for boats, carriages, factories, mills, and in all other places." "The use of this engine and boiler, will render the use of steam full fifty centum less expensive than those now in general use." Perhaps so, but we "have little hope, and no confidence."

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for improvements in the Saw Set. Granted to EBENEZER WHITING, *Berkshire, Tioga county, New York, October* 15, 1830.

To all whom it may concern, be it known, that I, Ebenezer Whiting, have invented certain improvements in the saw set, which improvements are applicable to saws of all descriptions, and that the following is a full and exact description of the same.

The saw set which I use operates upon the principle of punching, and is represented in the drawings which accompany this specification. Fig. 1, exhibits a convenient form for the saw set when used for hand, panel, or other similar saws. It has a shank by which it may be firmly fixed in a vice, or in a hole made in a bench for that purpose. The punch is sustained by a spring attached to the iron support, which is usually cast in one piece with the shank. A piece of tempered steel is let into the iron, immediately under the punch, and forms the bed between which and the punch the saw tooth stands when it is to be set. There are two pins, or wires, which serve as guides to the saw teeth as they are successively set. The punch is filed so that its two sides which meet between the pins, form an acute angle, so as to be adapted to the form of a saw tooth. A plate of brass, or other metal, upon which the blade of the saw is to rest, is made to raise, or lower, by means of screws, which are tapped into the iron part of the frame through which they pass, and swivel in the plate above. A bent spring bears upon the heads of the screws, to retain them in their places. (See Fig. 1.)

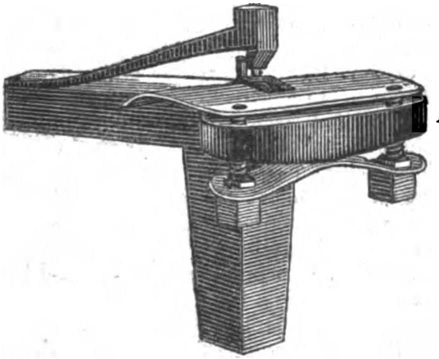


Fig. 1.

Fig. 2, is the same principle adapted to saw mill, cross cut, and other large saws. The pins which guide the teeth are not seen in the drawing, as they are hidden by the punch. They rise, however, from a steel bed, as in the former instance, and the punch, instead of being filed to an acute angle, is left square, and has two holes drilled in its face to admit the pins, and allow the punch to play. There are two screws by which to regulate the set of the saw, and also a bent spring. There is, on the back, a mass of cast iron which serves for a handle, and at the same time by its inertia, sustains the stroke of the hammer when a tooth is set.

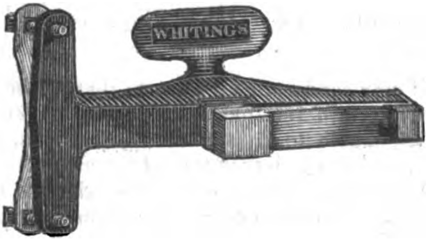


Fig. 2.

I do not claim the setting of saws by punching, the same having been heretofore practised; but what I claim as my improvements, are, the use of the two pins to guide the tooth of the saw; the making of the iron frame so that the limbs which contain the screws form a T with the body of the instrument; the mass of metal to prevent the recoil of the instrument when struck with a hammer; the manner in which the set is regulated by means of the screws, and the general arrangement of the whole to produce the intended effect.

EBENEZER WHITING.

Specification of a patent for a machine for Scraping the Flesh and Hair from Hides and Skins in the process of Tanning, and for Dressing the same, and also for all other scraping necessary in tanning, currying, and leather dressing. Also for cleaning wool on sheep skins, and taking the same therefrom. Granted to THOMAS WILLIAMS, *Rochester, Monroe county, New York, November* 4, 1830.

THIS machine consists of a wooden frame, in which is set a cylinder of wood furnished with four knives of steel or iron, so placed upon the cylinder as to form obtuse angles on opposite sides of the same. The cylinder is turned by horse or water power, or may be turned by a crank by hand. The object of the knives is to scrape the flesh, or hair, from the hides or skins; the edges may be made sharp, or obtuse, according to the purpose for which they are used. The hide, or skin, is placed beneath the cylinder between that and a bed piece, which bed piece is so made as to fit the lower surface of the cylinder. The hide, or skin, is carried under the cylinder, and kept smooth by the angular and spiral position of the knives. The object of the bed piece is to press the hide or skin equally upon the edge of the knife. The pressure is regulated by a weight attached to two levers, by which the bed piece is raised or lowered. These levers are attached to a weight which consists of a box or trough filled with weights; or, instead of a trough and weight, a spiral spring. This weight is raised or lowered by means of another lever, placed on the frame work, above, and connected with the weight by a rod or line. There is a small cylinder placed parallel to the one above described, and turned by a crank. The object of this cylinder is to wind up the hide or skin after it has undergone the process of scraping from the knives; the hide or skin is attached or fastened to the last mentioned cylinder, by pressing a part of it into a long mortise with a bar made to fit the mortise. THOMAS WILLIAMS.

Specification of a patent for an Inking Apparatus; being an improvement on the inking apparatus of Neal's vertical press, and applying the same to other presses. Granted to RICHARD WOOD, *City of New York, November* 4, 1830.

IN the application of this machine, the operator in turning the rounce handle, in order to run the bed, or coffin, of the press under the platen, turns the arbor which is connected with the rounce, which, drawing upon the strap fastened upon the barrel contiguous to the bevel wheel, winds up the weight hung upon the barrel, upon the sliding shaft to which this strap is attached; at the same time turning the two distributing rollers. In reversing the motion of the rounce, in order to withdraw the bed, the other barrel upon the arbor being held against the immoveable ratchet by the spiral spring, winds up the weight upon the other barrel of the sliding shaft; the motion of the arbor being reversed, the strap upon the other barrel unwinds from the barrel, and, the tympan being raised, pressing upon one of the levers before mentioned, bears off the barrel from the ratchet, and allows the strap on that also to unwind: the frisket being now raised; pressing upon the other lever, trips the catch which holds back the sliding shaft, and the weights now acting, one of them, hanging upon a strap which passes over a roller placed upon the back side of the fountain, draws the carriages with the shaft and fly wheels forward, and falling on the board fixed upon the lever placed across the lower part of the frame, bears down the lever and moves the fountain rollers; while the other weight, giving motion to the fly wheels, the elastic or composition roller, is made to pass twice over the form upon the press; by which time the strap that trips the catch which keeps the sliding shaft forward, having wound up, the stop at its end, trips the catch, and the weight continuing to descend, the straps extending from the sliding shaft to the arbor, having in the mean time been wound upon the shaft by its revolutions, so as to be drawn tight, the shaft is drawn back to its former position; bearing, in its return, upon the tail of the inking roller, which is raised from the fountain roller to the large distributing roller, and communicates to it a portion of ink. The operation may now be repeated.

The parts of this machine which I claim as my improvements and invention, besides its application to printing presses, other than "Neal's vertical printing press," are: the fixture for moving the catch which holds back the sliding shaft; that for moving the ratchet barrel upon the arbor, together with the rachet barrel; that for moving the fountain roller; the sliding rods and carriages; the longitudinal pieces at the ends of the frame, which give the arms of the roller a horizontal motion; the slot or range of holes in one spoke of each wheel, by which the roller may be made to traverse a greater or less space; the placing of the scraper of the fountain roller on the front side of the fountain by which ink may be more conveniently put into the fountain; and, the fixture for raising the inking roller from the fountain roller to the large distributing roller.

The advantages which the apparatus with my improvements possesses over Neal's apparatus, are: that, requiring much less weight, the apparatus is worked with proportionably less power; that, as the roller may be made to traverse a greater or less space, the apparatus may be adapted to forms of different magnitude, and, that the machine may be applied to printing presses in common use.

Richard Wood.

Specification of a patent for improvements on a mode of "Building Boats and Sea Vessels," patented on the 12th day of September, 1816. Granted to William Annesley, *Albany, New York, November* 6, 1830.

To all whom it may concern, be it known, that I, William Annesley, of the city of Albany, in the state of New York, did, on the twelfth day of September, in the year one thousand eight hundred and sixteen, obtain letters patent of the United States, for a mode "of building boats and sea vessels, without the ordinary timbers, excepting stem, stern posts, transom, gangway beams, and knees, by three or more courses of planking, on moulds, with tarred paper between each course." And that after many experiments, I have succeeded in making several improvements in my said mode of building vessels of all kinds, whether intended for river, or sea service, and that the following is a full and exact description of my said improvements, and of the manner in which the same are practically employed.

My former practice was to set up stem, stern post, and transom, with a fore and aft mould, outside from transom to stern, to give the fore and aft rake, and without kelson. My improvement in this part consists in laying a kelson, with the first fore and aft plank firmly attached to it, and projecting an inch, more or less, on which my vertical moulds rest, and using the interior fore and aft mould attached to the kelson.

My improved method of planking is effected as follows. My first fore and aft plank being parallel, and fastened to the kelson, I tack my spiling lath to the moulds, its edge bearing on the centre plank for a few feet, as a guide, and passing it up without bias, to the bow deck clamp, (or harping,) where it strikes, gives the cúrve of the centre fore and aft plank; the spiling being taken from the centre of the fore and aft mould to the inner edge of the lath, and transferred to the plank, having a centre line struck, and the spiling set off on each side, gives the lines of the first fore and aft plank, where the vessel is an equal figure from the centre. Thus, by having the planks parallel in the waist, a straight edge will lie along every seam when planked; being without stealers, or irregular figures, and one spiling will exactly fit all round, having the strike of equal width where the figure is equal. If not, it will require one spiling forward, and one aft, for every strake. The greatest possible strength is thus preserved in the planking, as the fibre of the wood is unbroken on the straight side. This may be perfectly understood by reference to the accompanying drawings.

When the first course is completed, it is payed over with a coat of pitch and oil, lime and tar, or some similar composition; and over this are placed sheets of tarred, or oiled, paper, as is likewise done between every course of planking; the process in this last particular being the same as in my former method of proceeding, is not claimed as making any part of my improvements.

A transverse course of planking is next to be laid on, from gunwale to gunwale, as far as the waist extends, to the rise fore and aft, it may be laid on in parallel straight plank, but where it begins to rise, spaces should be left equal to the breadth of the plank designed for use, to allow the plank free liberty to incline to the centre, and lie flat. The spaces are afterwards to be filled up by tacking a narrow thin lath in the centre of the space, and marking the distance between the edges of the plank, and transferring them to a plank having a centre line struck lengthwise and athwart, correctly, where the lath and centre of the bottom of the vessel correspond.

In vessels having an odd number of courses, as 3, 5, or 7, I place them alternately fore and aft, and athwart. For small boats, in two courses, I place the first outside, on the moulds, and bend in between the moulds the second, and remove the moulds as they interfere. When the moulds are removed the inner layer of planking is caulked, or wedged, and the outside may be caulked in the usual manner. But instead of caulking I have invented a mode of wedging, which I greatly prefer, and which I deem a very important improvement. The wedges which I use, are made of wood, and are a little longer than the thickness of the plank to be wedged, in order that the edges may bend, and thus key, when they come in contact with the planking beneath that to be wedged. The wedges, before they are driven, are dipped into white lead paint, which forms a perfect water proof cement.

In order to give a practical idea of my mode of procedure, I present the following account and description of the building of the De Witt Clinton steam vessel, at Ithaca, on Cayuga lake, in the state of New York. This vessel having been recently built, will serve to exemplify the improvements on my former patent, for which I now claim an exclusive right.

This vessel is 100 feet long on deck, her extreme breadth 18 feet 6 inches, her depth of hold 8 feet 10½ inches, and consists of four courses, as follows. First course, 1⅛ inch thick, white oak plank. The second and third courses are each ¾ inch thick, placed transversely, in succession. The fourth, or outside course, is 1¼ inch in thickness, making altogether a thickness of 3⅞ inches. The kelson, 65 feet in length, is of pine, 12 by 9 inches; with a centre plank 11 inches wide; it was laid on four uprights, sunk two feet, and rising three feet six inches above ground, and well braced. On each upright was placed 4 wedges, in two courses, all levelled fore and aft, and athwart; one pair to be driven out to permit the transverse planking to pass under, and then to be replaced to relieve the others. Her kelson was laid level, it being necessary to launch her broadside. Her fore and aft and vertical moulds being set up, the deck clamps, of two inch oak plank, 10 inches wide, in two courses, were fastened to the moulds by small iron clamps and screws, all being well braced. The perfect accuracy with which vessels can be built upon this plan, was evinced by the laying on of the first course of plank without the slightest alteration being required in the moulds.

The first course was laid with 20d. cut nails, and hutchocks, or wood stops, to permit them to be drawn; it was then thoroughly coated with pitch and oil. The second course of plank was bent round transversely, from gunwale to gunwale; the plank used was ¾ inch thick, and was fastened with 6d. cut nails; the wood stops being split off, and the nails of the former course drawn, as they interfered. A layer, or coat, of pitch and oil, was applied as before, and upon this one of oiled paper. The third course of ¾ inch oak plank, was laid in the same manner as the last, observing to break joints therewith. The fourth and last course of planking, which was 1¼ inch thick, was fastened with cut nails, 4 inches in length, and having square heads. The nails were prepared by heating them to redness, carefully, and equally, and plunging them in that state into fish oil; a film is thus spread over them which forms an impervious varnish, protecting them against rust for an indefinite length of time.

In laying this last course, after the centre fore and aft plank was first secured, its edges were then covered with a coat of stiff white lead paint, and every succeeding plank was treated in the same way; the whole outside seams being painted when the planking was finished; the moulds being then removed, the inside was caulked in the usual way.

The *next* operation was the wedging of the outside, to which I have *already* referred. The wedges were made of poplar, (or white wood,) and cut by tools made for the purpose, by which they were all cut to the same size. Those used were 4½ inches wide, 1½ inch long, 3-10 thick at the back, and 1-10 at the edge. The seams were opened in the usual manner, the points of the wedges dipped in stiff white lead paint, and driven nearly flush. When planed off, the whole surface exhibited an appearance of peculiar neatness, and of the most perfect solidity.

Two engine sills of 60 feet in length, 12 by 10 inches, were placed on *each side of* the kelson, at a foot apart; they were screw bolted through the bottom; there being bridging pieces of 2 inch pine plank, at 2 feet apart.

The bulk heads, four in number, were formed of two courses of inch pine plank, one course being upright, and the other horizontal. Their distance was such as to allow 65 feet for the length of the main cabin floor. This floor was also laid in two courses, the first athwart, and the second fore and aft. It was of 1¼ pine plank.

The stem, or cutwater, was now bolted on, leaving a rebate to receive the first fore and aft planking of the gripe. The stern also was cut through, to receive the stern post, which measured 14 by 10 inches, and rebated to receive the fore and aft planking of the dead wood, astern.

There are five beams athwart this vessel, three of which serve to support the boilers, which are carried on the wings.

In sailing vessels I use no beams, or carlines, but place two additional plank athwart, at the openings, to receive the comeings of hatchways, cabin, &c.

The decks of the De Witt Clinton were formed on the same principle with the body, being in three courses. Fore and aft pieces were fixed temporarily to give the curve to the deck. The upper course of planking was wedged, in the way before described.

When this vessel was completed, the vibration occasioned by the working of the engine, was scarcely perceptible. She was so tight, as to render it necessary to pump water into her to sweeten her; and three inches of water being kept in her, was, by absorption and evapбration, reduced to two, in 36 hours.

In large vessels for sea, I now form my moulds from a model, (cut into sections) of a figure to permit my cross planking to pass entirely round the waist, as far as the harpings, fore and aft. Thus forming, internally, an eliptic barrel, between the forward and aft bulk heads. To give the outside form, I place brackets at proper distances, and I continue the outside planking up. I sometimes form solid water ways of pine wood, in two or more courses, into which I mortise for my stanchions, plank up with oak, and place an oak plank for a cap, and to project, forming a moulding entirely round the gunwale.

Having thus given a description of my present mode of procedure in forming the hull of the vessel, I will now detail those particular improvements which I have made upon the methods used by me when my first patent was obtained; referring for a more perfect understanding thereof, to the drawings which accompany this specification, and to the explanatory references made thereto. I have also deposited a model in the patent office, built upon a scale of ½ inch to the foot.

In my former plan, a stern post and transom were set up. This mode is now rejected. In my improved mode I lay the kelson, with the first fore and aft plank laid on it, and projecting on each side an inch, more or less, on which the upright moulds rest. This I claim as new.

I now lay permanent deck clamps, in two or more courses, which are continued all round on the moulds, and attached to them by small iron clamps, and wood screws, to be drawn when the moulds are removed. I also lay my first course fore and aft with hutchocks, (or wood stops.) These methods I also claim as new.

The continuing the planking entirely round the waist, into the fore and aft deck clamps, and placing brackets, or water ways to form the outside, as above described, I claim as new.

I claim likewise my present method of planking in the fore and aft courses, whereby each plank has one straight edge, in consequence of which a flexible lath, the edge of which is straight, will lie to every seam. I claim also my manner of taking the spiling of the transverse courses, as explained in the account of the De Witt Clinton.

Instead of my former manner of setting up the stern post, the inserting of it through the body of the vessel above the deep water line; and the fitting my stem after the body is planked, caulked, or wedged; and the building my keel, where great length and depth are required, in courses, and gripe, and dead wood, as before described, and shown in my drawings, are claimed by me as new.

I likewise claim the substitution of wedging for the ordinary mode of caulking, in the manner and for the purposes herein described.

The method of laying the deck for open vessels, (that is, those not continued round entire in the transverse courses,) I claim as new. This consists in employing three or more courses, the first two laid athwart, and the upper course fore and aft, upon the principles and in the manner hereinbefore set forth.

WILLIAM ANNESLEY.

Abstract of the specification of a patent for a new mode of uniting Timber together, so as to combine great strength, compactness, and durability; which is applicable to many purposes in the business of civil architecture and engineering, such as the building of Bridges, Aqueducts, Domes, and many other structures. Granted to WILLIAM ANNESLEY, *Albany, New York, November* 6, 1830.

To all whom it may concern, be it known, that I, William Annesley, of the city of Albany, in the state of New York, have invented a new mode of uniting timber together, so as to combine great strength, compactness, and durability. This invention is applicable to many purposes in civil architecture and engineering, such as the building of bridges, aqueducts, domes, and many other structures. The general principle upon which I proceed being the same as that which is detailed in a specification or description of my mode of "building boats, and sea vessels;" for which I have applied to obtain letters patent of the United States, in an instrument of writing bearing date with the present.

And I do hereby declare that the following is a full and exact description of my said invention, and of the manner in which it may be carried into effect.

For the purpose of exemplification I have chosen a "groined arch bridge," an "aqueduct," and a "dome;" not, however, intending to restrict myself to these in the application of my invention, the essential feature of which is the forming of the structure, whatever it may be, by uniting together two, three, or more thicknesses, or layers, of plank or boards, some of which layers cross the others transversely; the whole being bent, or formed upon moulds, and closely united together, so as to be impervious to water, and to retain the shape given to them, after the mould by which it has been determined, is removed.

For a bridge, abutments are to be built in the usual way, and sills of the most durable timber being placed three or four feet from the faces of the abutments, are levelled to the curve of the arch, and firmly built in with stone and mortar. Uprights of suitable lengths, and at convenient distances apart, are fixed in the bed of the river, and properly braced, they rising to the height necessary for supporting the intended arch. The curve of the arch having been marked on these uprights, they are to be cut off fair to these marks. The first course of outside string pieces, are then laid, and fastened to the tops of the uprights by iron clamps and wood screws, which are afterwards to be drawn. This first course may be 10 or 12 inches in width, and four in thickness. A second plank course, of the same dimensions, is then laid on, breaking joints with the first. The arched transverse beams are then fixed in their places, and filled in between in two courses, as shown by the dotted lines; the upper one being trimmed to the transverse curve. These are all to be fastened together with oak pins. The first course of the centre string is now laid on and pinned to the beams, and the second laid flush with the beam and pinned. On these I commence laying my first course of groin arch, of two inch pine, using the longest plank which I can obtain. They are all made truly to a width, and bevilled to fit the transverse curve, and fastened to the beams with long cut nails. The next course of plank is laid athwart, pine 1¼ inch in thickness will answer. The third course may be 2 inches in thickness; a fourth transverse course, similar to the second, is then laid, and this is followed by the fifth, or last course. In laying this upper course longitudinally, the jointed edges of the plank should be coated with good white lead paint. The seams are afterwards to be wedged, in the manner described in the specification of my mode of "building boats and sea vessels." The last plank being 2 inches, the wedges should be 2½ inches long, 3-10 thick at the back, and 1-10 at the edge; those which I have used were 4½ inches wide, and were made of poplar, (white wood.) The seams are to be opened, as for caulking, the wedges dipped in white lead paint, and driven home, so as to clinch upon the transverse timber below.

The cut nails used may be preserved from rust by heating them red hot, and plunging them in fish oil; and between each course of planking, the whole surface should be payed over with pitch and oil, or some similar article; oiled paper also should be interposed throughout, between every layer, or course, of plank.

My plan of uniting timber may be applied to aqueducts, either open or close. When it is desired to erect an aqueduct at once in its proper place, a scaffolding must be raised to support it, as in bridge building. Aqueducts may also be built in sections, and these afterwards elevated, and united together.

The mode of procedure being generally the same with that followed in the building of bridges, I deem it unnecessary again to go into details.

What I claim as new, is, the uniting together of layers of wood in longitudinal and transverse courses, in the manner herein described, either in the building of bridges, aqueducts, or other structures; and generally the application of the same principle which I have adopted in the building of boats and sea vessels, to the erection of structures on land.

WILLIAM ANNESLEY.

Remarks by the Editor.—The space occupied by the foregoing specifications forbids our making any extended remarks upon the merits of Mr. Annesley's plans. We know, however, that he has devoted many years of his life, and expended large sums of money, in bringing them to their present improved state. In the building of vessels in particular, to which he has principally devoted his attention he has necessarily, at every step, had to encounter the self-interest, and the honest prejudices of the ship builders. His method is, as regards their business, a revolutionary measure, and should it eventually supersede the long established method of building vessels, it is not likely that he will ever reap the reward of his labours. Innovations of the description proposed, are rarely accomplished in a single generation.

That his plan of uniting timber will insure to his structures a greater degree of strength than can be obtained from the same weight of material, combined in any other way, we have no doubt. The strongest objection which presented itself when the plan was new to us, arose from an apprehension that the infiltration of water between the layers, would produce early decay. We, however, are assured, that after the experience of many years, no such effect has been produced.

Whether his mode of building may be as advantageously applied to the construction of the larger class of ships as to vessels of a smaller size, may admit of doubt: that those of considerable burthen may be so built, and that they will be strong and durable, has been abundantly proved, although constructed in a way much less perfect than that now adopted. We understand that Mr. Annesley is likely to have an early opportunity of building a government vessel upon his principles.

We have given but a small portion of the second specification, as our only object was to present the main features of the invention. The skilful mechanician will have no difficulty in perceiving how it may be applied to domes, aqueducts, and other structures.

Specification of a patent for a Labour-saving Tanning Apparatus. Granted to WILLIAM BROWN. *City of New York, November* 11, *1830.*

THE improvement herein claimed by the subscriber, is the connecting and concentrating of the various processes through which the hides pass before they become leather, by means of suitable machinery, into one apparatus, the construction of which is as follows.

There are four, or more, leatches, or cisterns, for infusing the bark, which are placed contiguous to the handlers, or vats, on the same level, but projecting at the top above them. These leatches, or cisterns, communicate with each other by means of tubes, inserted between them near the tops, and are supplied with false bottoms, which fit loosely, and which are perforated with holes, forming a kind of strainer. In each of the leatches is fixed an aqueduct or tube, which is used to convey the liquor from the bottom to the communicating tubes. By this contrivance the liquor is passed from the bottom of one leatch, into the top of the adjoining one, where it acquires a fresh portion of strength, and is thus propelled through the whole series, by pouring the water or weak liquor into the tops of the leatches, until it being of sufficient strength, arrives at the fourth or strongest leatch. There is also placed in one corner of each of these leatches, what is called an eye, which consists of a trunk projecting below the bottom of the leatch, and connected to a horizontal pipe, which serves to convey the liquor, when of sufficient strength, directly to the handlers, or vats; this trunk is supplied with a plug for regulating the quantity of liquor thus drawn off.

At a convenient distance from the leatches, and on the same level with them, is placed a heater, which consists of two or more horizontal copper, or iron, pipes, which are placed one above the other, and have connecting tubes near their ends. These pipes are attached to and communicate with another, of a square form, in which the fire is made. These pipes, or heaters, are secured within a cistern, with their ends projecting at one side, and have caps for the convenience of cleaning.

It will be seen that when a fire is kindled in the lower heater or box, the heat passes from it into the tube above at its farthest extremity, and comes forward and enters the next above, and so goes backward and forward until it enters the chimney at the opposite side, thus transmitting all the heat of the fire, to the liquor with which the cistern is constantly filled. There is a tube communicating with the heating cistern for supplying it with weak liquor or water, and communicates at its opposite extremity with a trunk or reservoir, which is furnished with a pump, by which the liquor is raised to the tube and forced into the heating cistern, which is kept constantly full by this means; the heated liquor passing off at a different tube, which communicates directly with the leatches. The leatches are filled with bark by means of a conveying trough communicating with the elevators of the mill.

The strong liquor or infusion passes from the bottom of the leatches as before mentioned, into a trunk passing into a horizontal position under them, and rises by a vertical tube inserted in said trunk, from which it is transmitted to another horizontal trunk communicating with the handlers, or vats, and passing along their upper surfaces. By this method the liquor from the leatches is transmitted into the tops of the handlers, or vats. At the bottom of the vertical tube, and within the lower horizontal trunk, is placed a valve moveable by means of a strap extending up through the said tube. This valve is to prevent the stronger liquor from entering the reservoir, and thus mixing with the weaker.

The liquor after having passed through the handlers, or vats, is drawn from their tops by means of a hollow plug inserted into the lower trunk before mentioned, and runs into the trunk or cistern, from whence it is again transmitted to the heaters, and so on to the leatches; so that the same liquor is continually in use; the evaporation and waste of which is supplied by water.

In each of the handlers is a reel, or cylinder, formed by two circular heads secured at the required distance apart by longitudinal bars; and having gudgeons which work in slides, for the convenience of elevating or depressing them at pleasure. The hides are secured on the inside of the reels by means of hoops, which encircle the reels a short distance from their heads, and have pins on their outer surfaces by which the hides are fastened; or they may be thrown loose into the reels.

The great saving of labour in this invention consists in the facility with which the hides may be kept in motion when immersed in the liquor. Each of the reels has a rag wheel attached to it, and is turned one notch at a time, by means of a shaft which is geared into a click, to be worked by hand, or may be moved by animal, water, or steam power. The piston of the pump in the trunk or reservoir, is attached to one of the shafts, and may be moved or unshipped at pleasure.

There is what is called a beam house connected with this apparatus, where the hides are first limed before they are put on the reels. The water which is necessary to mix the lime, is heated and supplied on the same principle as before mentioned for the leatches; and the piston of the pump attaches in a similar manner to the shaft. In laying away hides, it is necessary to have the ground bark which is put between them, moistened or damped, to prevent waste and dust. The contrivance for this purpose consists of a small cistern, elevated at a convenient height, and supplied with a spout perforated with holes, and a cock for regulating the quantity of water required to wet the bark, which is placed under it. The subscriber claims the privilege of using his improved labour-saving tanning apparatus, on as large or small a scale as he may require, and with any number of leatches and handlers. WM. BROWN.

Specification of a patent for a new and useful method of supplying the Boilers of Steam Engines with Water. Granted to JOHN S. WILLIAMS, *Maysville, Mason county, Kentucky, November* 17, 1830.

1. THERE must be a water chamber placed at the horizontal level, with the height the water is intended to maintain in the boiler, or boilers, intended to be supplied.

2. The water chamber must open into the supply water by a communication furnished with a valve opening toward the water chamber. The supply water must be higher than the water chamber, so as to run in of itself, or be forced in by a pump, or be drawn in by a vacuum.

3. The water chamber must open into the boiler intended to be supplied, below the height of the water it is intended to maintain in the boiler, by a communication furnished with a valve opening into, or towards the boilers.

4. The steam in the boiler above the water must open into the

water chamber above mentioned, by a communication which can be opened or shut at pleasure.

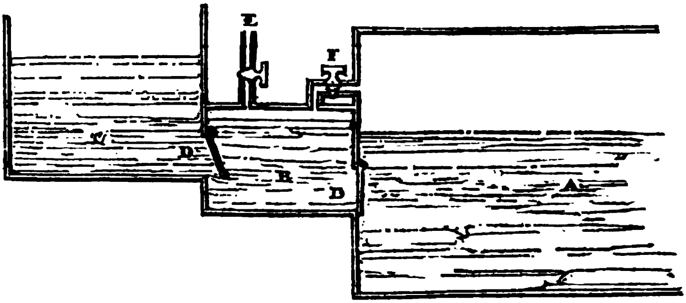
5. The water chamber must open upwards into the atmospheric air, or a vacuum, by a communication that can be opened or shut at pleasure.

It is evident from the principles of hydrostatics, that if the steam of the boiler be shut out of the water chamber, and the communication be opened upwards from the water chamber into the atmospheric air, or a vacuum, that the supply water will flow through the communication described in the second head, above, and fill the water chamber.

It is equally evident that if that communication described in the 5th head above, be then closed, and the steam in the boiler be let into the water chamber, by the communication described in the 4th head above, that the water in the water chamber will flow into the boiler through the communication described in the 3d head above, until the water in the water chamber, and that in the boiler, shall maintain one level.

It is also evident that by alternately opening and shutting the two communications described in the 4th and 5th heads above, that the water chamber will be alternately filled with supply water, and emptied into the boiler, as long as the alternate opening and shutting are continued. Hence it appears that the supply of water in the boiler will not only be kept up from without, but that it can never rise higher nor sink lower in the boiler than a line above the level of which the water chamber shall have sufficient capacity to supply the water in the boiler during one operation of alternately filling and emptying the water chamber. John S. Williams.

Explanation of the drawing illustrative of the apparatus.



A, boiler. B, water chamber. C, supply water. D, D, valves. E, F, cocks. When the cock, E, is open, and F closed, the pressure in the boiler will close the valve between it and B, and the supply water will flow into the water chamber, through the valve between it and C. Shut E, and open F, and the steam from the boiler will pass into B, its pressure will close the outer, and allow the inner valve to open, when the water will flow into the boiler, and stand at the same level in it and in the water chamber.

The capacity of the water chamber above the water line, must be equal to the waste of the water in the boiler during the filling and emptying of the water chamber. And if the operation of alternately opening and shutting E and F, be kept up, the water in the boiler will never rise higher nor sink lower than the water line, while the supply water continues in C.

Specification of a patent for an improvement in the mode of combining Printing Types for Music. Granted to GEORGE BRUCE, *City of New York, November 27,* 1830.

IN combining printing types for music in the manner here contemplated, the lines of the staves are formed with separate rules, and the characters are cast in sections, or pieces, to occupy the spaces between the lines or rules, being cut, or divided by the rules, wherever they intersect, and forming with them perfect characters.

I claim as my invention the use of separate rules, which, in combination with suitable types adapted to the spaces, between the rules, shall form perfect characters of any required description. By this method the lines of the stave are more perfect than by the old method of casting characters and lines together; kerned types are unnecessary, the number of characters is reduced, the use of them in printing facilitated, and the cost decidedly diminished.

GEORGE BRUCE.

Accompanying the foregoing specification are two specimens of printing with the types described. One of them the sections of types without the rules, which exhibits the spaces which the rules are to occupy. The other the types combined with the rules. Its appearance is neat and distinct, and we think it a real improvement on the former modes of casting types for printing music.

ENGLISH PATENTS.

To THOMAS PROSSER, *Architect, a patent for Certain Improvements in the construction of Window Sashes, and in the mode of hanging the same.* September 6th, 1830.

MR. Prosser proposes in this specification to attach the upper and lower sashes, to the same lines which pass over a pulley attached to each side of the frame near the top of the window. These are of the kind usually called side pulleys, which have their axes at right angles to the surfaces to which they are attached. The small frames in which the pulleys turn, are moveable in dovetailed grooves in the window-frames, and adjustable by a screw to regulate the tension of the sash-lines. The two sashes are thus made to balance each other, entirely obviating the necessity for the metallic counterpoises usually employed to facilitate the raising and lowering of the sashes. From this description, it will be perceived that one of the sashes cannot be moved without moving the other, so that the opening can never be made entirely either at the top or bottom of the window, but an equal portion of it will be at each.* The method of attaching the line to the sashes, consists in tying neatly to the ends of the lines small pieces of metal, with longitudinal rectangular slits, which pass over T studs, fixed into the sashes with their heads across, by which the lines are secured from being accidentally detached when once they are hooked on. Instead of the beads, which are generally fixed to the frame on each side of a window-sash, as guides to keep it in its place while stationary, and to preserve their perpendicular position while elevated or depressed, this patentee fixes a single rod into the frame, which fits accurately into a groove in the side of the sash. This constitutes a fitting less pervious to the weather than that usually adopted, at the same time that it affords great facility in cleaning the windows; for, as the guide-rod of the lower sash does not extend more than half way down, so that the lower sash being elevated to the top of the window escapes its guide-rod, and may be turned inside out, and the upper sash being lowered to the bottom, may be similarly reversed, and by this means all parts of the window can be brought within reach of a person in the room, for the purpose of cleaning or repairing.

The improvements here contemplated seem to be all good; but we consider the last mentioned will be extensively adopted, and become very useful; for the present method of cleaning the outsides of high windows is attended with much danger and inconvenience, or with much injury to the fittings by the frequent removal of the side beadings. [*Register of Arts.*

To William *and* Andrew Ramsay, *and* Samuel Orr, *Sail Makers, for an improvement in the manufacture of Canvass and Sail Cloth, for the making of sails.* September 20th, 1830.

The improvements contemplated by these patentees, consist in a method of making sail-cloth, or canvass, with the yarn constituting the weft in an oblique position, instead of crossing the yarn constituting the warp at right angles, according to the usual manufacture. To effect this the working parts of the loom, such as the batton frame and batton, the lames, the reed, &c. are made to shift upon the side frames to any required angle, and arranged so as to be secured by clamping or screwing, to preserve the necessary position during the weaving of any one piece of the canvass. The slits of the reed must be placed at the same angle with respect to its frame, as the frame itself makes with the side frames of the loom, that the reed may move freely between the threads constituting the warp.

---

* There is no novelty in the above mode of hanging sashes, as a patent was obtained for it in the United States, twelve or fourteen years since.

[Editor.

It will be perceived, that these modifications are equally applicable to the hand and power loom.

The advantages which canvass manufactured in this way possesses over that manufactured from yarn of the same quality, with the weft crossing the warp at right angles, is, a greater degree of strength when the principal tension or strain upon the sail, is made to coincide with the direction of the threads of the warp or weft, and this can always be done with sail-cloth manufactured as above described, for the sails are strained by application of force to the corners. This circumstance must, however, be attended to by the sail maker. [*Ib.*

To SAMUEL ROBERTS, *Silver Plater, for certain improvements in Plating or Coating of Copper or Brass, or mixtures of the same, with other metals or materials, or with two metals or substances upon each other; as also a method of making such kinds of articles or utensils, with the said metal when so plated as have hitherto been made either entirely of silver, or of copper or brass, or of a mixture of copper and brass, plated or coated with silver solely.* September 20th, 1830.

THE improvements invented by this patentee, consist in introducing a layer of white metal, as that mixture of zinc, nickel, and copper, denominated "*German Silver*," between the metal to be plated, and the silver with which it is plated. The advantage of this invention is, that when the silver wears off in parts, the defects are not readily perceived, as the under metal is very nearly of the same colour. The German silver is to be applied by a process precisely similar to that usually adopted in plating, and the real silver is then to be applied to the compound metal, which is to be moulded into form either before or after the process of plating, as circumstances may require. [*Ib.*

To WILLIAM AITKIN, *Esq. for certain improvements in the means of keeping or preserving Beer, Ale, and other Fermented Liquors.* September 24th, 1830.

IT has been long the practice to keep the fermented liquors either in casks or glass bottles, closely stopped, to prevent the escape of the carbonic acid gas, by which liquors would become flat. The preference being given to the plan of keeping it in small bottles, as far as regards the quality of the ale, beer, &c. for this enables the consumer to prevent any being exposed to the atmosphere, except the quantity which he may require for use at any one time. But this plan has been found too expensive for general introduction.

Now to unite the advantages of the bottles, with the economy of the barrels, is the object of Mr. Aitkin's patent, and he proposes several methods of carrying the object into effect; in all of which he preserves the liquor under pressure, to prevent the escape of the carbonic gas. One plan is to make the barrel cylindrical, with an air-tight piston moveable within it; that it may be forced down upon the surface of the beer, by a screw or otherwise, whenever a quantity is abstracted for use. Another method is to introduce within the cask, which may be made of the usual form, a kind of elastic bag or vessel, of sufficient capacity to fill the cask. This bag must be made of materials impervious to air and moisture; and as the beer is withdrawn, the bag is expanded to occupy the place, by injecting air or water: and thus an uniform pressure is preserved upon the beer as long as any remains in the cask. [*Ib.*

To Richard Ibotson, *Paper Manufacturer, for an improvement or improvements in the method or apparatus for Separating the Knots from Proper Stuff or Pulp, used in the manufacture of paper.* November 29th, 1830.

Hitherto much difficulty has been experienced in clearing the stuff or pulp of which paper is made, of the small knots, which are invariably found in it, and which, if not separated, necessarily diminish the quality of the paper. The sieves or strainers which have been generally employed for separating the knots, have been either so wide in the meshes as to permit the smaller knots to pass through, or else they very soon get clogged up, for it is evident that the fibres of which even the finest paper is made, are considerably longer than one of the meshes in the sieve, and hence they will, instead of passing through, be deposited across the meshes, and immediately render the sieve useless.

To remedy these imperfections, Mr. Ibotson manufactures his sieves or strainers, which he applies to the paper machines distinguished by the term Fourdrinier's machines, of metallic bars, giving the preference to gun-metal, made flat on the upper surface, and about half an inch wide, or at all events of a width greater than the length of any of the fibres in the pulp. The bars are strengthened, by a projection extending along the middle of their lower sides, so that the cross section of one of the bars may be represented by the letter T. These bars are in a frame at a distance from each other, corresponding with the intended quality of the paper for which the sieve is to be used. He has designed, however, a very ingenious method of adjusting the distances between the bars, so as to make the sieve answer for the manufacture of paper of different qualities. For this purpose he makes all the bars to taper uniformly, and fixes every alternate bar with its narrow end towards the same side of the sieve; and he frames the other bars together, but does not fix them to the sieve; they are introduced between the fixed bars with their narrow ends in a contrary direction. By this arrangement it is evident that the distances between may be diminished or increased to any degree of nicety, with the greatest facility, by pushing the frame of loose bars forwards or backwards, which is effected by means of adjusting screws. The sieve is to be placed in a trough conveniently situated, to receive the pulp from the hog or machine by which the rags are torn to pieces, and agitated into the consistence of pulp. One side of the sieve, which is made of the form of a rectangular parallelogram, is attached by hinges to the trough, and the other is connected with a set of cam-wheels, by which it is elevated and depressed with great rapidity; and when the sieve gets clogged up by the knots which it separates from the pulp, its surface is to be cleaned by a rake or brush, made of hard bristles. This seems to be a highly ingenious invention, and in the hands of a practical man as it is, it cannot fail to become useful to the public. [*Ib.*

To JAMES HOLMES BASS, *Gentleman, for certain improvements in machinery for Cutting Corks and Bungs.* December 3d, 1830.

MR. Bass having prepared the cork by cutting the sheets into blocks, of the length of the required cork, and of a width corresponding with the thickness of the sheet from which they are taken, fixes the blocks successively between two chucks, in a kind of lathe, by which a slow rotary motion is communicated to them, while a frame knife is brought in contact with the circumference of the intended cork; the plane of the blade being made to coincide with a tangent to the curve. To give to the cork the requisite degree of tapering, the knife is made to approach nearer to the axis of motion at one end than the other. To the knife frame, which is supported on cams of different sizes, which are to be brought into action according to the size of the cork or bung to be cut, a sawing or slicing action is communicated by cranks and connecting rods, from the main shaft of the apparatus. As a great portion of the sheet of cork imported into this country is too thin to be cut into circular corks, of the required size for common bottles, it has been the practice of cork cutters, to make their corks somewhat elliptical, in order to save material; finding that the compression of the cork in one direction will expand it in another, and make it form, though of an elliptical shape, a perfect stopper to a circular opening. To accommodate his machine to this economical mode of cutting, Mr. Bass makes his cams which support the knife frame, of an elliptical form; and as the rotation of the cams are made to coincide with the rotation of the cork holders, the corks will be cut of an elliptical form, as if they had been manufactured by hand.

The principle and arrangements of this machine are highly creditable to the ingenuity and judgment of the patentee, who will doubtless reap the benefit of his labours. [*Ib.*

To John Wilks, *Engineer, Millwright, and Machinist, one of the copartners in the firm of* Bryan, Donkin, & Co. *Engineers, Millwrights, and Machinists, for an improvement or improvements in a part or parts of the apparatus for making Paper by Machinery.* October 24, 1830.

The improvement contemplated by this patentee, is, the application of an additional roller to the machines used in the manufacture of paper, and known by the name of Fourdrinier's paper machines. The additional roller is to be perforated, and it is intended to facilitate the escape of the water from the pulp web, previously to its being subjected to the pressing rollers. Still more to facilitate the abstraction of the water, Mr. Wilks proposes to employ the pressure of the atmosphere, by making a vacuum within that part of the perforated roller on which the paper web rests.

The method of making these rollers is described to consist of the following processes. A piece of sheet copper, brass, or other suitable metal, is bent and soldered in the form of a tube, whose length is equal to the circumference of the intended roller, and whose circumference is equal to the length of the intended roller, making an allowance for the waste at the ends. The tube is then to be drawn on trebletts, in the usual manner, and afterwards turned truly cylindrical on the mandril on which it was drawn. A series of grooves, eight or ten in number, are then turned half through the tube, with a tool the sixteenth of an inch wide, and so made as to make the bottoms of the grooves as wide as their tops. The tube is then taken from the mandril, cut open, and bent inside out and soldered in the form of another tube, whose length shall correspond to the circumference of the first, thus constituting a hollow cylinder with longitudinal grooves inside. It is to be again drawn and turned with grooves to the amount of twenty-four in the inch, these will of course cross the other at right angles, and being cut half through as before, the entire surface will be composed of transverse ridges and rectangular perforations.

When it is desired to employ the exhausting principle, a second perforated cylinder is introduced with the first. The inner cylinder must be made smooth inside, that it may fit air tight upon a sectoral cavity extending from the axes to the circumference, enclosing about an eighth part thereof, opposite to the place covered by the web of paper as it passes over the roller. The air is pumped from this cavity through the axis, which is made hollow for that purpose, by an air pump of the usual construction. When this method of abstracting the water is employed, the roller must be put in motion by a train of wheel work, so arranged that it may coincide precisely with the motion through the machine. [*Ib.*

To George Harris, *Captain in the Royal Navy, for improvements in the manufacture of Ropes and Cordage, Canvass, and other fabrics or articles, from substances hitherto unused for that purpose.* Enrolled March, 1830.

The object of this invention is to produce a rope, or sail cloth, which shall be impervious to water.

The patentee proposes to employ as the substance of his improved ropes or cordage, a vegetable production, called *silk grass*, which, when dried, is to be beaten and heckled in the same manner that flax or hemp is usually prepared. In the process of preparing the grass, it is proposed to introduce a bituminous and gummy material, which is intended to saturate the fibres of the grass, for the purpose of preserving the ropes, cordage, or sail cloth, or any other fabric made from it, when exposed to the effects of damp.

This gummy material is to be compounded of the milk of a tree called the *ficus indica*, with *aspultum*, or *bitumen judaicum*, and *cocoa nut oil*. The proportions are to about twenty-five gallons of the milk, one gallon of the oil, and from one to twenty gallons of the bitumen, according to circumstances.

These substances when properly combined, which may be done over a slow fire, constitute a gummy material, into which the fibres of the grass may be dipped while heckling, and it also may be applied in twisting or spinning. It is likewise proposed that the workmen in twisting the strands of cord, shall dip their hands in the material, and work it well into the fibres and texture of the rope.

When this gummy material has become dry, it will resist water, and prevent the rotting effects of damp upon the fibres of the rope, cordage, sail cloth, or other articles manufactured from it.

[*Lond. Journ.*

To William Fawcett, *Engineer, and* Matthew Clark, *Engineer, for their invention of an improved apparatus for the better Crystallization of Sugar from the Canes.* Enrolled June, 1828.

The leading feature of this invention is the application of high pressure steam to the external surfaces of sugar pans or vessels in which the cane juice is boiled, for the purpose of concentrating its crystals, that is, evaporating the aqueous parts from the sugar.

Any peculiar form or disposition of the vessels does not appear to be essential; but such an arrangement must be adopted, as will allow of the steam from a high pressure boiler to be brought in contact with, or surround, the several pans in which the molasses, or cane juice, is placed for evaporation.

It is proposed to construct a very strong steam boiler of wrought or cast iron, having the furnace and flues within surrounded by the water, so that little or no heat may be lost by radiation. This boiler is to be proved to bear the resistance of steam at a pressure considerably greater than it will ever be required to be employed, and safety valves are to be placed in suitable situations, to prevent explosion. On the top of this boiler the sugar pans are to be mounted, with jackets surrounding their lower surfaces, connected by flanches packed steam tight. From the boiler, pipes are to be laid, for the purpose of conducting the high pressure steam into the spaces between the pans and their jackets, the heat of which will cause the molasses, or cane juice, in the pans, to boil, without subjecting it to burning, or baking on to the internal surface of the pan.

The pans may be connected in any other way with a generator of high pressure steam, which steam may be conducted under the pans by pipes or other means, and the steam boiler or generator may be employed at the same time to drive the engine, or other machinery connected with the sugar works.

The ends of the flues in the boiler are to discharge themselves into other flues leading to the chimney, but they must be furnished with dampers, to prevent the heat from passing away too freely; and additional pans may be placed in connexion with the chimney or flues, by which the heat of the vapour and smoke may assist in preparing the liquor for the crystallizing process. [*Ib.*

To Henry Roper, *Esq. a Rear Admiral in our Royal Navy, for his having invented a new and improved system of Signals; first, for communicating by day, by the means of flags and pendants between ships at sea, or other objects far distant from each other; in which system the colours of the flags and pendants which have heretofore served to distinguish the signals one from another, and which by distance or other causes are extremely subject to be mistaken, may be dispensed with altogether; and, secondly, for communicating by night, between ships at sea and other objects far distant from each other, by the means of lights; and which system of signals is more conspicuous, expeditious, and certain, than any which has hitherto been employed for the like purpose.* Enrolled August, 1827.

The features of this invention are almost as fully described in the above title as in the specification itself. The object of the patentee does not appear to be that of altering altogether the system by which signals or telegraphic communications are made from one ship to another at sea, but to simplify the process, by forming the subjects intended to be communicated into classes, and adapting to each class of subjects, peculiar signals at the onset, leading to the kind of correspondence intended to be carried on. By so doing the number of signals, consisting of flags and pendants, are reduced from forty-eight, the ordinary complement, to only twenty-two, and of course are less expensive, more easily worked, and not so liable to mistake as when a greater number are employed.

These signals are intended to represent numerals, and by being placed at different elevations, point out whether units, tens, hundreds, or thousands; and the number thus shown, referring to a signal book, indicates by the corresponding number in the book, the word or sentence designed to be expressed.

The device upon the flag or pendant is sometimes to be the signal, at other times the colour of the flag or pendant is to be the significant mark, and at night time lanterns, with coloured glass of divers shapes, are to be employed instead of flags.

In conjunction with these, balls and other marks are to be occasionally employed; but as the specification does not point out the modes of working them, (which indeed depends upon the previous arrangement of the sentences, word, or syllable, in the signal book,) it would be useless for us to extend our description of the patentee's views further. [*Ib.*

On SHALDER'S *patent Fountain Pump.*

[To the Editors of the London Journal of Arts and Sciences.]

GENTLEMEN,—Of all machinery adapted to the general uses of life, none is so universal, and none more important than that which is constructed for the purpose of raising water from one situation to another. It therefore follows that any improvement by which this object may be effected with greater facility, convenience and despatch, becomes of the highest value to the world, and as far as regards mechanical invention, is of greater consequence in this than in any other species of machinery.

To prove this assertion, it would only be necessary to point out the numerous attempts which have been made to accomplish this desirable end. It has been the research of learned and scientific men; but many centuries have elapsed, and we have still found the same mode handed down to us, with all its acknowledged imperfections. In the invention which I am about to introduce to the reader's notice, every former deficiency is remedied, and the object required is produced by the most direct and satisfactory means, leaving no desideratum; and there is no doubt, from the strong testimonials of its efficacy, that in the course of a short time this invention will wholly supersede every other method at present in use.

When the principle of this fountain pump is thoroughly understood, its advantages are sufficiently obvious, and to those who do not comprehend its construction, or are at a loss to perceive its peculiar mode of action, I need only refer to the numerous demonstrations of its superiority. These facts decide at once in its favour.

I am now only speaking of its comparative working properties, and increased power in raising water; but when to these it is added that the fountain pump is more durable, more economical, and more simple in its construction, there can be no hesitation in yielding to it the most decided preference, whether applied to the arts, navigation, or domestic purposes.

In the common pump, when properly made, the piston should fit the inside of the working barrel so closely as to form a perfect vacuum, that the leather or packing may press hard against the sides of the cylinder; this consequently produces, when the pump is in action, an irregular, unsteady resistance, while independently of the unnecessary waste of power to counteract friction, produces an uneasy stiffness in motion, which soon wearies the performer. By the advantages possessed in the invention under consideration, no friction occurs, and these defects are wholly obviated.

With the common pump, solid substances, as hard pieces of wood, particles of sand, &c. &c. are very apt to insinuate themselves between the bucket and the barrel; these may either unpack the piston, or by grinding and tearing the leather, or forming grooves in the barrel, render it totally unserviceable, until it again passes through the hands of the maker. In this improvement the connecter is so constructed as to cast up and deliver solid substances with as great facility as it does the fluid, and without the possibility of injury or derangement to the workmanship.

In the pump constructed upon the new principle, the bucket is surrounded by a strong pliable leather tube, which I call the connecter, of a conical figure, or the diameter of one end is rather less than that of the other; this is supported by the expresser or bucket when in movement, and easily admits of being inverted and retroverted. Its lesser circumference is closely secured to the upper and outer extremity of the expresser; and the larger circumference is fastened to the inner part of the cylinder between two flanches. This effectually precludes the possibility of leakage, as the connexion is completely cut off between the upper and lower portion of the barrel, except through the valve of the bucket. Thus we have the three grand defects of the common pump, from friction, choking, and leakage, entirely remedied; besides, as before stated, less original expense, less wear and tear, and greater simplicity.

The operation of the pump on the improved plan may be compared to the action of lifting through the air a bucket of water, suspended to the counter end of a lever, or pump handle. Supposing the bucket at each depression of the handle to empty itself, and to refill at each elevation, we have a representation of its mode of action, there being neither more nor less friction in resistance in the one instance than the other. There is only the weight of the water to contend with, and so ample is the power gained by the adaptation of the new principle, that double the work may be accomplished in a given time; in other words, that one man may perform the work of two; or what would occupy a man two days to complete, may be finished in one day.

The following is a description of this invention given by a scientific gentleman of acknowledged talent:—"This improvement is designed to avoid the friction of an ordinary pump, by substituting in place of the usual air and water tight packing of the piston or bucket, a flexible tube or diaphragm surrounding the bucket, which rises and falls with it. Fig. 1, represents the bucket with its diaphragm and other appendages detached from the pump and shown in perspective.

Fig. 2, is a geometrical section of the same taken through the middle perpendicularly; and Fig. 3, is a plan or horizontal view of the same, as it would appear when seen from above. In all which figures similar letters refer to corresponding parts; *a*, *a*, is the bucket or piston of the pump, having two valves, *b*, *b*, opening upwards as usual; *c*, *c*, are bent arms, for the purpose of attaching the bucket to the pump rod at *d*, by which the bucket is to be raised and lowered in the pump barrel, by means of the pump handle, or by any other common contrivance.

Fig. 1.

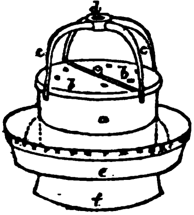


Fig. 2.

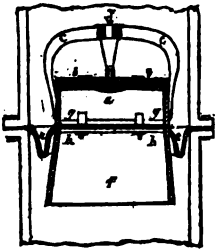
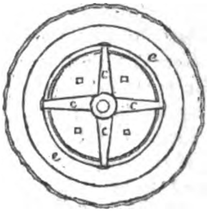


Fig. 3.



"The diaphragm, *e*, *e*, is a tube of leather or other suitable flexible material, which is air and water tight. It is made from a disk of leather, rather larger in diameter than the interior of the pump barrel, in the centre of which a circular hole is to be cut, rather smaller than the interior of the bucket, which gives it the form of a broad ring; this ring of leather is then soaked and pressed upon a block until it is brought into the form of a frustrum of a cone, very much resembling in shape a round hat, with the centre of the crown removed; the frustrum having a narrow rim at bottom on the outside, and a similar rim at top on the inside, which two rims are for the purpose of attaching the diaphragm to the pump barrel, and to the bucket.

"To the lower part of the bucket a cylindrical or bell formed tube, *f*, is attached, for the purpose of preventing the diaphragm from collapsing under the bucket when the pump is in action. At the lower part of the bucket there is an internal flanch, *g*, *g*, and a corresponding flanch, *h*, *h*, at the upper part of the bell formed tube, which two flanches take hold and confine the inner rim of the diaphragm, and are held together by screws, bolts, and nuts, as seen in Fig. 2. The outer rim of the diaphragm is in a similar way held securely between flanches in the pump barrel, and by these means the upper and lower parts of the pump barrel are separated, and an air and water tight partition formed, without packing the bucket as in ordinary pumps.

"It will now be seen that on the ascent or descent of the bucket, the diaphragm being flexible, will readily rise and fall, leaving the water way clear, and effecting all the purposes of a tight bucket or piston, without producing any of the friction which results from the employment of a bucket fitted closely to the barrel, as in pumps of the usual construction."

Experiments have been frequently made with this improved pump, by introducing sand, fragments of wood, gravel, apples, &c. &c., yet any substance capable of passing the valves has been ejected along with the water, without the least impediment or detriment. There is likewise a large body of evidence from practical manufacturers, who have made use of the fountain pump for different purposes, for various periods, from one to four years; these distinctly assert its manifest superiority, and amply confirm the character just given of it.

The patent pump is confidently recommended to engineers, as being the most efficient machine to remove or supply large bodies of water. By the aid of the steam engine its operations would be prodigious, while the saving of fuel and attendance would reduce the expenses by one half. To water companies it will shortly become an essential auxiliary, and it will be the duty of those who have the public trust reposed in them to employ it. The same observations will apply to mining operations, either to those conducted by public associations, or by private individuals; with them it is indispensable, as it is the only machine not liable to embarrassment by the presence of sand, gravel, &c. &c. It is well known that many mines, after much delay and expense, have been abandoned from this very cause.

To road surveyors its utility is conspicuously pointed out; in watering the roads, despatch is requisite, as the watering ought to be finished in the early part of the day; double the number of carts may be engaged at once, and the whole be completed in one-quarter the time, and at half the expense.

To breweries it will become a necessary appendage, as it may be easily removed from one place to another; the work will be concluded in one-half the time, or boys may be substituted for men, which, in the course of a year, will produce a material saving. The same remarks are applicable to tanneries, to pump the water and ooze; in distilleries, the wash and spirit; and in dye houses, the dye, &c.; for these purposes the pumps may be constructed of wood, &c. at a very trifling prime cost. For brickmakers, excavators, &c. it is the only pump suitable to their purposes.

The utility of the pump is so general, that it may be said that no establishment of any description is complete unless so provided; in the house, in the garden, in the stable yard, pumps on this improved principle are most particularly adapted, as children or females can work them with the greatest ease, and when out of order, though seldom, they may be repaired without the aid and expense of a plumber.

For the purposes of agriculture in dry seasons, they may be employed on an extensive scale to irrigate the land, as the labour of supplying water is so materially diminished; and when used for the purpose of drainage, large tracts of land may be brought into cultivation.

In nursery grounds and large gardens, where diffusion of water is so essential, they will become a valuable acquisition.

In our West India possessions, and other colonies, where large supplies of water are required for cattle, and numerous other services, the fountain pump will become a necessary apparatus; those they have in use at the present time, are, generally speaking, extremely defective; this circumstance arises from the common pump being so soon out of order, from its defect in principle, and from being little understood, except by workmen, who most usually reside at a distance.

Proprietors of estates are, therefore, particularly enjoined to direct their attention to this object, as they can always have the independent means of possessing a superior and more powerful machine, easily repaired, and attended with infinitely less expense. Those who desire to have the ordinary friction pump process replaced by one on the new plan, have no necessity to alter the former arrangement of pipes, machinery, &c.; it would only be requisite to supply a new cylinder and expresser. The principle of the improvement can also be applied to the forcing pump, where it still preserves its extraordinary advantages. For fire engines, deep wells, and to supply elevated situations, it is admirably calculated. In short, to those who are zealous in real improvement, or have economy in view, the fountain pump is earnestly recommended as a machine whereby much time and outlay will be ultimately saved; in every instance where a pump is required, it is infinitely superior, and in some instances it will not admit of substitution.

I am, gentlemen, yours, &c.

John Elliott,
Civil Engineer.

Remarks on the different Modes of Applying Power for Locomotive Purposes.

Sir,—The subject of rail-ways and steam-conveyance at present occupying so much of the public attention, the following brief remarks, on the different modes of applying power for the purpose of locomotion, may not be thought inconsistent with the objects of your publication. In the late exhibitions which took place on the Liverpool and Manchester Rail-way, the tremendous velocity of the engines exceeded not only the most sanguine expectation of the public, but the engineers even who designed and constructed them, have been agreeably surprised at the gratifying results of their own labour and ingenuity. By these performances the opinion which was formerly entertained of the speed in travelling, concomitant with safety, having experienced such an extraordinary revolution, we are prompted to look forward to the future, and endeavour, by taking an impartial view of the subject, to ascertain the limit at which the progressive advancement of improvement will eventually terminate.

The great object which constantly requires to be kept in view in advancing and perfecting the art of locomotion, whether on rail-ways or common roads, is to find out the best and most efficient mode of stowing, economizing, and applying a certain quantity of power, or momentum, sufficient to impel the appended load to a convenient distance by overcoming the retarding forces, which are always co-existent with every kind of motion. The most important causes of this continued retardation, are the attrition and cohesion of all those parts of an engine, or carriage, which come in contact with each other. Before a carriage, however, has attained the requisite velocity, the moving power has to overcome the whole inertia of the mass corresponding to this velocity; and this at first, and afterwards, when the velocity varies, forms a considerable item in rail-ways of the force required to be exerted in locomotion. When different inclinations obtrude themselves on rail-ways and roads, another cause of retardation presents itself, which requires to be particularly observed when considering the best mode of applying power in overcoming these several obstacles. In the use of them for this purpose, the mode of its generation and application introduce a material waste of power, which it appears impossible to obviate, from no means being applicable for regulating, exactly, the quantity of heat evolved in combustion, or of economizing it by condensing the steam after it has performed its duties. In the usual manner, likewise, of estimating the steam power required to be exerted in moving the same load at different velocities, any increase in the latter is always accompanied by an equal augmentation of the former. But since no difference exists in any of the retarding forces, except that of the increased inertia at first opposing its resistance, it follows that the quantity of power supplied is greater than the force required to be overcome. This waste ensues principally from the rapid vibration of the piston, impeding the transference of the full power with which the steam is charged, and might perhaps be partly obviated by using cylinders of different lengths and diameters, connected by corresponding leverage in such a manner, that although the momentum was sufficient to supply the requisite power, yet the velocity of transference should be at first moderate, and afterwards, by a combination of machinery, gradually augmented till sufficient for direct application to the wheel. But the existence of the other difficulties which have to be encountered, and which have been already enumerated, must completely baffle the success of such expedients.

On the whole, when we contemplate the application of steam power to overcome a resisting force which continually varies, it appears altogether inadequate to sustain that system of economy which it is necessary to preserve. It has presented such serious obstacles to locomotion on common roads, as have, as yet, entirely prevented its successful application; and on rail-ways, although the general effects are striking, on moving over a level track, yet on ascending an inclination of even one in ninety-six, the velocity of the carriage is so far retarded, that if the length of such an inclination exceeded two or three miles, an entire stoppage might be expected, if some more important improvements in the steam locomotives are not effected. In looking forward to the future, therefore, we are warranted to expect some new modification of the system, which may prove adequate to accomplish all that can be desired in remedying the defects which are here taken notice of, and approaching finally the goal of perfection. The following analytical observations, by ascertaining and examining the causes of insufficiency, appear to hint at these requisite modifications, although the adoption of the views here taken of this subject, must be entirely influenced by the judgment derived from the practical experience of professional men.

From what has already been observed, it will have been rendered obvious that the steam-engine works to most advantage, when it communicates adequate force by a moderate velocity of the piston; to apply this kind of power, therefore, to the purposes of locomotion, an intermediate agent becomes necessary, which, by receiving the continued and unvaried supply, may act as a reservoir of force, which could always furnish the exact quantity of power competent to sustain the carriage at the same velocity. This agent requires to unite portability with the capability of receiving and transmitting the same power without loss; it must be, therefore, elastic and of a minimum weight; in fine, an aeriform fluid appears in the most perfect manner to be endued with all the requisite essentials for this purpose. We are in this manner led to the direct conclusion, that the most expedient method of supplying power to a locomotive carriage is from a reservoir of condensed air, which may be continually replenished by the unvarying action of steam. In condensing air, when no time is allowed for the heat to dissipate, the mass acquires an increase of temperature equal to one degree of Fahrenheit's scale for every condensation equal to 1-480 of the whole bulk. Thus, when the chamber which contains the air is small in comparison to the velocity of condensation, a quantity of heat will be extricated, which will materially add to the elastic force, and therefore to the power required to be applied, which will be immediately lost in the reservoir from the balance of temperature being restored. To remedy this, it becomes necessary that the primary condensation takes place in a large chamber, where time might be allowed for the superabundant heat to disperse. But this is not concomitant with the maximum bulk, which it is necessary both engine and reservoir should occupy in a locomotive carriage; a separation must therefore ensue, and whilst the steam-engine is stationary, the reservoir of the locomotive might be supplied by others of superior magnitude, appended to a stationary engine situated at each end of the rail-way, if not exceeding 30 or 40 miles in length, or when longer at convenient intermediate stages. By following this mode of arrangement, the air would have an equal temperature, and, from the size of the chamber affixed to the carriage, the contained air, during the process of exhaustion, would have time to supply the transient deficiency of temperature from the ambient atmosphere, whilst the velocity of its motion would tend further instantaneously to restore the equilibrium.

Many particulars are, however, to be minutely considered before the practicability of this mode of storing up power can be demonstrated; the most important of them shall here be attempted to be submitted to rigorous calculation, although practical proof can alone establish the efficacy of the principles upon which it is founded.

The elasticity of air augments in a ratio nearly equal to that of condensation; since the pressure, therefore, of the atmosphere is nearly 15 lbs. on the square inch, when condensed air is confined in a vessel it will exert on a square inch of its surface a pressure equivalent in pounds to 15 times the number of enclosed atmospheres. If the power of traction be represented by the constant impeding force, multiplied by the space gone over, the momentum of elasticity contained in the reservoir, calculated in a similar way, must be equivalent to this product. Thus, if the space required to be gone over in inches is represented by S, the constant force of retardation in pounds by W, the contents of the reservoir in cubic inches by C, and the number of contained atmospheres by A, then $SW = \frac{15\ A^2C}{2}$: if any three of these quantities are therefore given, the fourth may be found by this equation. If A is supposed constant, and equal to 50, while we reckon W = 500, which, on a level rail-way, is sufficient to draw a load of about 45 tons; the contemporaneous values of S and C may be exhibited in miles and cubic feet, forming the two first columns of the following table:—

S in miles	C in cubic feet	C increased five times	Diameter of spherical chamber.
1	.978	4.890	2.106
5	4.890	24.450	3.601
8	7.824	39.120	4.212
10	9.780	48.900	4.537
12	11.736	58.680	4.822
15	14.670	73.350	5.191
18	17.604	88.020	5.517
20	19.560	97.800	5.716
25	24.450	122.250	6.157
30	29.340	146.700	6.541
35	34.230	171.150	6.886
40	39.120	195.600	7.202

The third column represents the values of C, increased five times, that the whole quantity, which is required to be abstracted from the reservoir, may not introduce any inconvenient change of density; which, by varying and lessening the expansive energy, may render it inapplicable to the machinery through which it acts. The fourth column shows the dimensions of the reservoir, considered as spherical, although two or more smaller vessels may contain together as much as one of larger dimensions, without requiring a greater weight of metal (see note A.)

Note (A.) If t represents the thickness of the shell of a spherical chamber, D its diameter, p the pressure on its internal surface, and M the modulus of cohesion of the substance composing the shell, then $p\ D = 4\ M\ t$. Let δ represent

In ascending any inclination, the extra force required to be expended will be proportioned to the load multiplied by the whole height of ascent. In addition, therefore, to the whole distance on rail-ways and roads considered as level, there must be included the sum of the heights of all the ascents which occur in this distance, and the power expended in both, estimated according to the foregoing methods, will give the full quantity required to be supplied to a locomotive carriage. To illustrate this, let the Liverpool and Manchester Rail-way be taken as an example. The whole length is 29 miles, which, by the third column of the table, gives the number of cubic feet 141.8. In proceeding from the west to the eastern termination of the rail-way, the sum of all the ascents amounts to 230 feet; and although the descents amount to 141 feet, which will materially lessen the power required to be exerted, yet this advantage may be overlooked from the impossibility of exactly estimating it; and the quantity of condensed air to be allowed for the rise of 230 feet will amount to $500 \times 200 \times 230 = SW = \frac{15\,A^2 C}{2}$, or $C = 8.5$ and $5\,C = 42.6$. The whole number of cubic feet will therefore be 184.4, which is the contents of a spherical chamber, 7 feet in diameter, or of two, 5½ feet each. We may, therefore, consider a reservoir of these dimensions, when applied to a locomotive carriage, sufficient for the conveyance of a load of 45 tons, the whole length of the Liverpool and Manchester Rail-way.

Various mechanical expedients suggest themselves as necessary apparatus, to connect the store of power with the wheels of the carriage; but, indeed, little difficulty can be experienced in suiting the arrangements of machinery to the exigencies which present themselves, although they must differ considerably from the usual mode of forming the cylinder and valves of the steam-engine, and must

---

the evanescent linear magnitude of supposed distension; the increment of surface corresponding to the assumed diameter $D + 2\,\delta$ will be $4\,\pi$[*] $D\,\delta + 4\,\pi\,\delta^2$, which also represents the virtual velocity of the cohesive momentum of the spherical shell. This being equably distended, the force will be equally exerted in every direction, and may be resolved into two which shall be equal and perpendicular to each other. If the substance of the shell, retaining the original thickness, was arranged in the form of a square, the virtual velocity in the direction of one side will be represented by $2\,\pi\,D\,\delta$, and, multiplied by Mt, gives the virtual momentum of cohesion $= 2\,\pi\,D\,\delta\,Mt$. The virtual momentum of pressure, which is to counterbalance this, being half the aggregate of the distending force on the whole surface will be represented by $\frac{1}{2}\,\pi\,p\,D^2\delta$, which being equal to $2\,\pi\,D\delta\,Mt$, by reducing the equation, we have $4\,Mt = p\,D$ or $t = \frac{p\,D}{4\,M}$, $D = \frac{4\,M\,t}{p}$ and $p = \frac{4\,M\,t}{F}$. Thus, if we suppose the elasticity of air proportional to its density, the quantity of material necessary to confine, by this mode, the same quantity of power, is always constant, whatever be the diameter of the spherical chamber; for quantity of power $\cdot|\cdot\ p\,D^3$ and quantity of material $\cdot|\cdot\ t\,D^2$, but $p\,D^3 \cdot|\cdot\ 4\,Mt\,D^2 \cdot|\cdot\ t\,D^2$, therefore $p\,D^3 \cdot|\cdot\ t\,D^2$.

[*] π Here represents the ratio of the circumference of the circle to its diameter.

be accommodated to variations in the elasticity of the condensed air, and in the velocity of the carriage.

The next subject of any importance to be considered in estimating the expediency of the system, is the weight of the reservoir and necessary appendages of the carriage, that a comparison may be instituted between this and the present weight of locomotives, with the fuel and water necessary to carry them 30 miles. From the formula before demonstrated (see note A,) the thickness of an iron spherical chamber, 7 feet in diameter, perfectly sufficient to sustain pressure of 50 atmospheres on its internal surface will be 1.05 inches, and the whole metal required $= 7^2 \times 3.1416 \times .0875 =$ 13.468 cubic feet; which, at 480 lbs. per cubic foot, amounts to 2 tons 18 cwt. and estimating the attending machinery and framework of the carriage as a maximum at 1 ton, we have about 4 tons for the whole weight of the carriage, which would be reduced to 2½ if it renewed its supply, like the steam-engine, at the end of 15 miles. Thus it competes with the lightest locomotive that has yet been constructed, that if the weight of the water and fuel, which must accompany every steam locomotive, be included in the estimate, it must eventually display a decided superiority.

[TO BE CONTINUED.]

On Gunpowders and Detonating Matches. *By* Andrew Ure, M. D. F. R. S. &c.

(Concluded from page 112.)

3. *On the Charcoal.*

Tender and light woods, capable of affording a friable and porous charcoal, which burns rapidly away, leaving the smallest residuum of ashes, and containing, therefore, the largest proportion of carbon, ought to be preferred for charring in gunpowder works.

After many trials, made long ago, black dogwood came to be preferred to every plant for this purpose, but modern experiments have proved, that many others afford an equally suitable charcoal. The woods of black alder, poplar, lime tree, horse chesnut, and chesnut tree, were carbonized in exactly similar circumstances, and a similar gunpowder was made with each, which was proved by the same proof mortar: the following results were obtained:—

	Toises.	Feet.
Poplar—mean range, - - - -	113	2
Black alder, - - - - - -	110	4
Lime, - - - - - - - -	110	3
Horse chesnut, - - - - - -	110	3
Chesnut tree - - - - - -	109	

By subsequent experiments, confirmatory of the above, it has been further found, that the willow presents the same advantages as the poplar, and that several shrubs, such as the hazel nut, the spindle tree, the dogberry, the elder tree, the common sallow, and some others, may be as beneficially employed; but whichever wood be used, we should always cut it when full of sap, and never after it is dead; we should choose branches not more than five or six years old, and strip them carefully, because the old branches and the bark contain a larger proportion of earthy constituents. The branches ought not to exceed three-quarters of an inch in thickness, and the larger ones should be divided lengthwise into four, so that the pith may be readily burned away.

Wood is commonly carbonized, in this country, into gunpowder charcoal, in cast iron cylinders, with their axes laid horizontally, and built in brick work, so that the flame of a furnace may circulate round them. One end of the cylinder is furnished with a door, for the introduction of the wood and the removal of the charcoal; the other end terminates in a pipe, connected with a worm tube, for condensing the pyroligneous acid, and giving vent to the carburetted hydrogen gases that are disengaged. Towards the end of the operation, the connexion of the cylinder with the pyroligneous acid cistern ought to be cut off, and a very free egress opened for the volatile matter, otherwise the charcoal is apt to get coated with a fuliginous varnish, and to be even penetrated with condensable matters, which materially injure its qualities.

In France the wood is carbonized for the gunpowder works, either in oblong vaulted ovens, or in pits, lined with brick work or cylinders of strong sheet iron. In either case the heat is derived from the imperfect combustion of the wood itself to be charred. In general, the product in charcoal by this method, is from sixteen to seventeen parts by weight, from one hundred of wood. The pit process is supposed to afford a more productive return and a better article, since the body of wood is much greater, and the fuliginous vapours are allowed a freer escape. The surface of a good charcoal should be smooth, but not glistening.

The charcoal is considered, by the most scientific manufacturers, to be the ingredient most influential, by its fluctuating qualities, on the composition of gunpowder; and therefore it ought always to be prepared under the vigilant and skilful eye of the director of the powder establishment. If it has been kept for some time, or quenched at first with water, it is unsuitable for the present purpose. Charcoal, extinguished in a close vessel by exclusion of air, and afterwards exposed to the atmosphere, absorbs only from three to four per cent. of moisture; while red hot charcoal, quenched with water, may lose by drying twenty-nine per cent. When the latter sort of charcoal is used for gunpowder, a compensation in weight must be made for the water present: but charcoal, which has remained long impregnated with moisture, affords a most detrimental constituent to gunpowder.

4. *On mixing the Constituents and forming the Powder.*

The three ingredients being thus prepared, are ready for manufacturing into gunpowder; they are, 1st, separately ground to a fine powder, which is passed through proper silk sieves or bolting machines; 2nd, they are mixed together in the proper proportions, which we shall afterwards discuss; 3d, the composition is then sent to the gunpowder mill, which consists of two edge stones of a calcareous kind, turning by means of a horizontal shaft, on a bed stone of the same nature, incapable of affording sparks by collision with steel, as sand stones would do. On this bed stone the composition is spread, and moistened with as small a quantity of water as will, in conjunction with the weight of the revolving stones, bring it into a proper body of *cake*, but by no means to a pasty state. The line of contact of the rolling edge stone is constantly preceded by a hard copper scraper, which goes round with the wheel, regularly collecting the caking mass, and bringing it into the track of the stone. From fifty to sixty pounds of cake are usually worked at one operation under each mill stone. When the mass has thus been thoroughly kneaded and incorporated, it is sent to the corning-house, where a separate mill is employed to form the cake into grains or corns. Here it is first pressed into a hard firm mass, then broken into small lumps, after which the corning process is performed by placing these lumps in sieves, on each of which is laid a disk or flat cake of *lignum vitæ*. The sieves are made of parchment skins, perforated with a multitude of round holes. Several such sieves are fixed in a frame, which, by proper machinery, has such a motion given to it, as to make the *lignum vitæ runner* in each sieve move about with considerable velocity, so as to break down the lumps of the cake, and force its substance through the holes, in grains of certain sizes. These granular particles are afterwards separated from the finer dust by proper sieves and reels.

The corned powder must now be hardened, and its rougher angles removed, by causing it to revolve in a close reel or cask, turning rapidly round its axis. This vessel resembles somewhat a barrel churn, and is frequently furnished inside with square bars, parallel to its axis, to aid the polish by attrition.

The gunpowder is finally dried, which is now done generally with a steam heat, or in some places by transmitting a current of air, previously heated in another chamber, over canvass shelves, covered with the damp grains of powder.

5. *On the Proportion of the Constituents.*

A very extensive suite of experiments, to determine the proportions of the constituents for producing the best gunpowder, was made at the Essonne works, by a commission of French chemists and artillerists, in 1794.

Powders, in the five following proportions, were prepared:—

	Nitre.	Charcoal.	Sulphur.	
1	76	14	10	Gunpowder of Bâle.
2	76	12	12	Gunpowder works at Grenelle.
3	76	15	9	M. Guyton de Morveau.
4	77.32	13.44	9.24	Idem.
5	77.5	15	7.5	M. Riffault.

The result of more than two hundred discharges, with the *proof mortar*, showed that the first and third gunpowders were the strongest, and the commissioners in consequence recommended the adoption of the third proportions; but a few years thereafter it was thought proper to substitute the first set of proportions, which had been found equal in force to the other, as they would have a better keeping quality, from containing a little more sulphur and less charcoal. More recently still, so strongly impressed have the French government been, with the high value of durability in gunpowders, that they have returned to their ancient *dosage* of seventy-five nitre, twelve and a half charcoal, and twelve and a half sulphur. In this mixture the proportion of the substance, powerfully absorbent of moisture, viz. the charcoal, is still further reduced, and replaced by the sulphur or the conservative ingredient.

If we inquire how the *maximum* gaseous volume is to be produced, from the chemical reaction of the elements of nitre on charcoal and sulphur, we shall find it to be by the generation of carbonic oxide and sulphurous acid, with the disengagement of nitrogen. This will lead us to the following proportions of these constituents:—

	Hydrogen=1	Per Cent.
1 prime equivalent of nitre,	102	75.00
1 " " sulphur	16	11.77
3 " " charcoal	18	13.23
	136	100.00

The nitre contains five primes of oxygen, of which three, combining with the three of charcoal, will furnish three of carbonic oxide gas, while the remaining two will convert the one prime of sulphur into sulphurous acid gas; the single prime of nitrogen is, therefore, in this view, disengaged alone.

The gaseous volume, on this supposition, evolved from one hundred and thirty-six grains of gunpowder, equivalent in bulk to seventy-five grains and a half of water, or to three-tenths of a cubic inch, will be, at the atmospheric temperature, as follows:—

	Grains.		Cubic inches.
Carbonic oxide, - - - -	42	=	141.6
Sulphurous acid, - - -	32	=	47.2
Nitrogen, - - - - -	14	=	47.4
			236.2

being an expansion of one volume into 787.3. But as the temperature of the gases, at the instant of their combustive formation, must be incandescent, this volume may be safely estimated at three times the above amount, or considerably upwards of two thousand times the bulk of the explosive solid.

But this theoretical account of the gases developed, does not well accord with the experimental products usually assigned, though these are probably not altogether exact. Much carbonic acid is said to be disengaged, a large quantity of nitrogen, a little oxide of carbon, *steam of water, with carburetted and sulphuretted hydrogen.* From experiments, to be presently detailed, I am convinced, that the amount of these latter products, printed in italics, must be very inconsiderable indeed, and unworthy of ranking in the calculation; for, in fact, fresh gunpowder does not contain above one *per cent.* of water, and can therefore yield little hydrogenated matter, nor is the hydrogen in the carbon of any consequence.

It is obvious, that the more sulphur is present, the more of the dense sulphurous acid will be generated, and the less forcibly explosive will be the gunpowder. This is sufficiently confirmed by the trials at Essonne, where the gunpowder that contained twelve of sulphur and twelve of charcoal in one hundred parts, did not throw the *proof shell* so far as that which contained only nine of sulphur and fifteen of charcoal; the conservative property is, however, so capital, especially for the supply of our remote colonies, and for humid climates, that it justifies a slight sacrifice of strength, which at any rate may be compensated by a small addition of charge.

Table of Composition of different Gunpowders.

	Nitre.	Charcoal.	Sulphur.
Royal Mills at Waltham Abbey, -	75	15	10
France, national establishment, - -	75	12.5	12.5
French, for sportsmen, - - -	78	12	10
———, for mining, - - - - -	65	15	20
United States of America, - -	75	12.5	12.5
Prussia, - - - - - - -	75	12.5	12.5
Russia, - - - - - - -	73.78	13.59	12.63
Austria, - - - - - - -	76	11.5	12.5
Spain, - - - - - - -	76.47	10.78	12.75
Switzerland, (a round powder,) - -	76	14	10
Chinese, - - - - - -	75	14.4	9.9
Theoretical proportions, (as above,) -	75	13.23	11.17

6. *On the Chemical Examination of Gunpowders.*

I have treated five different samples; 1. The government powder, made at Waltham Abbey; 2. Glass gunpowder, made by John Hall, Dartford; 3. The treble strong gunpowder of Charles Lawrence and son; 4. The Dartford gunpowder of Pigou and Wilks; 5. Superfine treble strong sporting gunpowder of Curtis and Harvey. The first is coarse grained, the others are all of considerable fineness. The specific gravity of each was taken in oil of turpentine; that of the first and last three was exactly the same, being 1.80; that of the second was 1.793, reduced to water as unity.

The above density for specimen first, may be calculated thus:—

75 parts of nitre, specific gravity = 2.000
15 parts of charcoal, specific gr. = 1.154
10 parts of sulphur, specific gr. = 2.000

The volume of these constituents is 55.5, by which, if their weight, 100, be divided, the quotient is 1.80.

The specific gravity of the first and second of the above powders, including the interstices of their grains, after being well shaken down in a phial, is 1.02. This is a curious result, as the size of the grains is extremely different. That of Pigou and Wilks, similarly tried, is only 0.99; that of the battle powder is 1.03, and that of Curtis and Harvey is nearly 1.05. Gunpowders thus appear to have nearly the same weight as water, under an equal bulk; so that an imperial gallon will hold from ten pounds to ten pounds and a half, as above shown.

The quantity of water that 100 grains of each part with on a steam bath, and absorbed when placed for twenty-four hours under a moistened receiver standing in water, are as follows:—

100 grains of Waltham Abbey, lose 1.1 by steam heat, gain 0.8 over water.

Hall, - - - -	0.5 - - - -	2.2
Lawrence, - - -	1.0 - - - -	1.1
Pigou and Wilks, - -	0.6 - - - -	2.2
Curtis and Harvey, -	0.9 - - - -	1.7

Thus, we perceive, that the large grained government powder resists the hygrometric influence better than the others; among which, however, Lawrence's ranks nearly as high; these two are, therefore, relatively the best keeping gunpowders of the series.

The process, most commonly practised in the analysis of gunpowder, seems to be tolerably exact. The nitre is first separated by hot distilled water, evaporated, and weighed. A minute loss of salt may be counted on, from its known volatility with boiling water. I have evaporated always on a steam bath. It is probable, that a small proportion of the lighter and looser constituent of gunpowder, the carbon, flies off in the operations of corning and dusting; hence, analysis may show a small deficit of charcoal below the synthetic proportions originally mixed. The residuum of charcoal and sulphur, left on the double filter paper, being well dried by the heat of ordinary steam, is estimated, as usual, by the difference of weight of the inner and outer papers. This residuum is cleared off into a platina capsule with a tooth brush, and digested in a dilute solution of potash, at a boiling temperature. Three parts of potash are fully sufficient to dissolve out one of sulphur. When the above solution is thrown on a filter, and washed first with a very dilute solution of potash, boiling hot, then with boiling water, and afterwards dried, the carbon will remain; the weight of which, deducted from that of the mixed powder, will show the amount of sulphur.

I have tried many other modes of estimating the sulphur in gunpowder more directly, but with little satisfaction in the results. When a platina capsule, containing gunpowder spread on its bottom, is floated in oil, heated to 400° Faht. a brisk exhalation of sulphur fumes rises, but at the end of several hours, the loss does not amount to more than half the sulphur present.

The mixed residuum of charcoal and sulphur, digested in hot oil of turpentine, gives up the sulphur readily, but to separate again the last portions of the oil from the charcoal or sulphur is hardly possible.

When gunpowder is digested with chlorate of potash and dilute muriatic acid, at a moderate heat, in a retort, the sulphur is acidified; but this process is disagreeable and slow, and consumes much chlorate. The resulting sulphuric acid, being tested by nitrate of baryta, indicates, of course, the quantity of sulphur in the gunpowder. A curious fact occurred to me in this experiment:—After the sulphur and charcoal of the gunpowder had been quite acidified, I poured some solution of the baryta salt into the mixture, but no cloud of sulphate ensued. On evaporating to dryness, however, and redissolving, the nitrate of baryta became effective, and enabled me to estimate the sulphuric acid generated, which was, of course, ten for every four of sulphur.

The acidification of the sulphur, by nitric or nitromuriatic acid, is likewise a slow and unpleasant operation.

By digesting gunpowder with potash water, so as to convert its sulphur into a sulphuret, mixing this with nitre in great excess, drying and igniting, I had hoped to convert the sulphur readily into sulphuric acid; but on treating the fused mass with dilute nitric acid, more or less *sulphurous* acid was exhaled; this occurred, even though chlorate of potash had been mixed with the nitre to aid the oxigenation.

The following are the results of my analysis, conducted by the first described method:—

100 grains afford, of	Nitre.	Charcoal.	Sulphur.	Water.	
Waltham Abbey	74.5	14.4	10.0	1.1	
Hall, Dartford	76.2	14.0	9.0	0.5	loss 0.3
Pigou and Wilks	77.4	13.5	8.5	0.6	
Curtis and Harvey	76.7	12.5	9.0	1.1	loss 0.7
Battle gunpowder	77.0	13.5	8.0	0.8	loss 0.7

It is probable, for reasons already assigned, that the proportions mixed by the manufacturers may differ slightly from the above.

The English sporting gunpowders have long been an object of desire and emulation in France: their great superiority for fowling-pieces, over the product of the French national manufactories, is indisputable: unwilling to ascribe this superiority to any genuine cause, M. Vergnaud, Captain of French artillery, in a little work on fulminating powders, lately published, asserts *positively*, that the English manufacturers of "poudre de chasse" are guilty of the "chalatanisme" of mixing fulminating mercury with it. To determine what truth was in this allegation, with regard at least to the above five celebrated gunpowders, I made the following experiments:—

One grain of fulminating mercury, in crystalline particles, was mixed in water with 200 grains of the Waltham Abbey gunpowder, and the mixture was digested over a lamp, with a very little muriatic acid. The filtered liquid gave manifest indications of the corrosive sublimate, into which fulminating mercury is instantly convertible by muriatic acid, for copper was quicksilvered by it—potash caused a white cloud in it, that became yellow, and sulphuretted hydrogen gas separated a dirty yellow white precipitate of bisulphuret of mercury. When the Waltham Abbey powder was treated alone with dilute muriatic acid, no effect whatever was produced on the filtered liquid by the sulphuretted hydrogen gas.

Two hundred grains of each of the above sporting gunpowders were treated precisely in the same way, but no trace of mercury was obtained by the severest tests. Since, by this process, there is no doubt but one 10-1000th part of fulminating mercury could be detected, we may conclude, that Captain Vergnaud's charge is groundless. The superiority of our sporting gunpowders is due to the same cause as the superiority of our cotton fabrics; the care of our manufacturers in selecting the best materials, and their skill in combining them.

7. *On Detonating Matches.*

This subject has been so ably treated in the report of MM. Aubert, Pellissier, and Gay Lussac, that I shall confine myself to a few observations, the results chiefly of my own experience.

Mr. Howard's proportions of the ingredients for preparing his fulminate of mercury, are—

Mercury, - - - - - - - - -	100 grains.
Nitric acid, sp. gr. 1.3, 1½ measured ounces -	= 884
Strong alcohol, 2 measured ounces, - - -	= 750

The mercury is dissolved by heat in the acid—the solution is allowed to cool to a blood heat, and then poured into the alcohol. On heating the mixture slightly, an effervescence soon ensues, the commencement of which is the signal for removing the heat from the matrass or retort, for if it be continued for some time longer, the chemical action will become furious, and the fulminate will be injured by an admixture of subnitrate of mercury. After the crystalline powder precipitates, the whole is to be thrown on a filter, washed, and dried on a steam bath.

The authors of the above report say, the best proportions are those of Howard, but they appear to estimate them incorrectly, for they prescribe twelve of nitric acid and twelve of alcohol, (by weight,) to one of mercury; we may hence infer, that considerable latitude may be used in the proportions of the materials. I consider the latter ones wasteful, since 100 of mercury, with 950 of nitric acid, 1.35 and 850 alcohol 0.835, produce about 120 parts of a perfect fulminate. The supernatant liquid retains nearly five per cent. of the mercury, for five grains of a dark gray oxide may be obtained from it by ammonia.

I have analyzed the match powder collected from fifty detonating caps of French manufacture, taken from a stock found to answer very well in practice. The whole weighed exactly 16.3 grains, being about one-third of a grain per cap. Treated with hot water, it yielded 8.5 grains of soluble matter, of which 7.0 grains were nitre, and 1.5 nitrate of mercury, derived from the ill made fulminate. By boiling again in water, this passed into a yellow subnitrate.

7.2 grains of insoluble matter were brushed off the dried filter, and heated with dilute muriatic acid. The solution being thrown on a filter, this retained one grain of carbon and sulphur, while 6.2 grains of fulminate of mercury passed through in the state of a bichloride. The proportions of this match powder must have been, therefore, eight grains of a kind of gunpowder, and about eight of indifferent fulminate of mercury, and yet it exploded very well; it obviously contained more nitre than usually enters into gunpowder.

The proportions deduced by the French commissioners, from their elaborate and able researches, are ten of fulminate and six of pulverin, (gunpowder meal.)

One hundred grains of fulminate, triturated with a wooden mullar on marble, with thirty grains of water and sixty of gunpowder, are sufficient to mount four hundred detonating caps.

In describing the formation of fulminating mercury, I omitted a curious fact that lately occurred to me. Desirous of moderating the reaction of the mixture which had been overheated, I added a little alcohol from time to time, till its quantity was increased by nearly one-half. The fulminate being washed, and laid out on the filtering paper in the air, when nearly dry, minute brilliant points were observed to start up on different parts of its surface, which becoming larger, were found to be globules of mercury: this metallization went silently and slowly on till nearly one-half of the powder disappeared: an ethereous hydrocarbonate was evidently the agent in this unexpected reduction. [*Journ. Royal Institution.*

REPORT ON MR. BABBAGE'S CALCULATING ENGINE.

Report of the Committee appointed by the Council of the Royal Society, to consider the subject referred to in Mr. Stewart's Letter, relative to Mr. Babbage's Calculating Engine, and to report thereupon.

Your committee, in this their report, have no intention of entering into any consideration of the abstract mathematical principle on which the practicability of such a machine as Mr. Babbage's relies, nor of its public utility when completed. They consider the former as not only sufficiently clear in itself, but as already admitted and acted on by the council in their former proceedings. The latter they regard as obvious to every one who considers the immense advantage of accurate numerical tables in all matters of calculation, especially in those which relate to astronomy and navigation, and the great variety and extent of those which it is professedly the object, and within the compass of Mr. Babbage's engine to calculate, and print with perfect accuracy.

The original object of the present machine was to compute any tables which could be calculated by six orders of differences, and twelve figures in each, and sixteen figures in the table itself, in such a form that, by bestowing a very moderate degree of attention to their publication, it would be impossible for a single figure to be erroneous; and supposing any person employing them to entertain a doubt whether that moderate degree of care had been bestowed, he might in a short time himself verify the tables. The machine was intended to produce the work stamped on plates of copper, or other proper material.

Besides the cheapness and celerity of calculation to be expected from it, the absolute accuracy of the printed results being one of the prominent pretensions of Mr. Babbage's undertaking, the attention of your committee has been especially directed, both by careful examination of the work already executed, and of the drawings, and by repeated conferences with Mr. Babbage to this point. And the result of their inquiry, is, that such precautions appear to have been taken in every part of the contrivance and work which they have examined, and so fully aware does the inventor appear to be of every circumstance which may by possibility introduce error, that they have no hesitation in saying they believe these precautions effectual, and that whatever the engine does it will do truly.

In the actual execution of the work they find that Mr. Babbage has made a progress, which, considering the very great difficulties to be overcome in an undertaking so novel, they regard as fully equalling any expectations that could reasonably have been formed: and that although several years have now elapsed since the first commencement, yet that when the necessity of constructing plans, sections, elevations, and working drawings of every part; that of constructing, and in many cases inventing, tools and machinery of great expense and complexity, (and in many instances of ingenious contrivances, and likely to prove useful for other purposes hereafter,) for forming with the requisite precision parts of the apparatus dissimilar to any used in ordinary mechanical works; that of making many previous trials to ascertain the validity of proposed movements; and that of altering, improving, and simplifying those already contrived and reduced to drawings; your committee are so far from being surprised at the time it has occupied to bring it to its present state, that they feel more disposed to wonder it has been possible to accomplish so much.

The drawings form a large and most essential part of the work; they are executed with extraordinary care and precision, and may be regarded as among the best that have ever been constructed. On these all the contrivance has been bestowed, and all the alterations made, so that scarcely any work excepting drawing has been thrown away. When it is mentioned that upwards of 400 square feet of surface are covered with drawings, many of them of the most elaborate description, it will easily be understood that a very great expense of time, thought, and capital, must have been incurred in producing them, but without which your committee consider that success would have been impossible.

Nearly the whole of this department of the work, (according to Mr. Babbage's statements, probably nine-tenths,) is completed, and what remains is of a nature to afford no difficulty on the score of contrivance; so that there is no reason why the execution of the work, (hitherto necessarily retarded till the completion of the drawings,) could not now proceed with rapidity; and according to what the committee have been enabled to gather from Mr. Babbage's statements and their own observations, and supposing no unexpected cause of delay, they regard a further period of three years as probably sufficient for its completion.

In judging of the adequacy of Mr. Babbage's work to complete the objects for which it was intended, there are two distinct questions—the adequacy of the contrivance, and that of the execution. On the former point every explanation has been afforded by Mr. Babbage, and both the drawings and the work executed have been unreservedly subjected to their discussion, and have been such as to excite a well grounded confidence. The movements are combined with all the skill and system which the most experienced workmanship could suggest.

But in so complex a work, in which interrupted motions are propagated simultaneously along a great variety of trains of mechanism, it might be apprehended that obstacles would occur, or even incompatibilities arise, from the impracticability of foreseeing all the possible combinations of the parts, and of which, on a mere inspection, your committee could not be expected to form a judgment. But this doubt, should it arise, your committee consider as fully and satisfactorily removed by the constant employment by Mr. Babbage of a system of mechanical notation, devised by himself, and explained in a paper in the Transactions of this Society; which places at every instant the progress of motion through all parts of this or any other mechanism distinctly in view, and, by an exact tabulation of the times required for all the movements, renders it easy to avoid all danger of two contradictory impulses arriving at the same instant at any part.

Of the adequacy of the machinery to work under all the friction and strain to which it can ever be fairly exposed, and of its durability, your committee have not the least doubt. Great precautions are taken to prevent the wear of the parts by friction; and the strength, solidity, and equilibrium, in the whole apparatus, ensure it from all danger on the score of violence or constant wear.

It ought also constantly to be borne in mind, that in all those parts of the machine where the nicest precision is required, the wheel work only brings them by a first approximation, (though a very nice one,) to their destined places; they are then settled into accurate adjustment by peculiar contrivances, which admit of no shake or latitude of any kind.

The machine consists essentially of two parts, a calculating part and a printing part. These are both equally essential to the fulfilment of Mr. Babbage's views; for the whole advantage would be lost, if the computations made by the machine were copied off by human hands and transferred to type by the usual process. The actual work of the calculating part is in great measure constructed, although not put together, a portion only having been temporarily fitted up for the inspection of the committee; and from its admirable workmanship they have been able to form a confident opinion that it will execute the work expected from it. At the same time, the committee cannot but observe that, had inferior workmanship been resorted to, such is the number and complexity of the parts, and such the manner in which they are fitted together, the success of the undertaking would have been hazarded; and they regard as extremely judicious, although, of course, very expensive, Mr. Babbage's determination to admit of nothing but the very best and most finished work in every part; a contrary course would have been false economy, and might have led to the loss of the whole capital expended on it.

In the printing part less progress has been made in actual execution than in the calculating. The reason being the greater difficulty of its contrivance, not for transferring the computations from the calculating part to the copper, or other plate ultimately destined to receive them, but for giving to the plate itself the number and variety of movements which the forms adopted in printed tables may call for in practice. The movements necessary for effecting this, being entirely such as might at any time be decided on, were purposely allowed to stand over till the more difficult parts should be fully developed. Taking the calculating and the printing part together, and regarding the tools and machinery already erected as available for the performance of what remains, the committee regard it as not improbable that three-fifths of the work may be already completed, but they cannot be expected to state this with any degree of certainty.

With regard to the expense incurred, and likely to be incurred, Mr. Babbage states the sum already expended by him at £6000; £1000 of which he states to have been laid out in preliminary trials, which have not formed an object of inquiry with the committee. Taking into consideration the extent of the work and drawings, which they have examined, and judging entirely from the general knowledge of the cost of these and similar works, which the professional experience of several individuals of the committee has enabled them to acquire, they are no way surprised at the outlay thus stated to have been incurred. With regard to the future cost, they have, of course, less means of judging than of the past,—of which they see the results, and the tools with which they have been produced. A probable conjecture might be grounded on the proportion of $\frac{3}{5}$, assumed as the proportion of the work already done; but this would require to be received with very great latitude.

Finally, taking into consideration all that has been already said, and relying not less on the talent and skill displayed by Mr. Babbage as a mechanician, in the prosecution of this arduous undertaking, for what remains,—than on the matured and digested plan and admirable execution of what is accomplished, your committee have no hesitation in giving it as their opinion, that "in the present state of Mr. Babbage's engine, they do regard it as likely to fulfil the expectations entertained of it by its inventor."

(Signed,) I. F. W. Herschel.
Chairman.

New System of Water Power.

A DESCRIPTION and plans of a mode of supplying public works with water as a moving power in all situations, and at all seasons of the year, have been introduced lately into Scotland, by an engineer of the name of Thom, which promises to be of the greatest advantage to this country, not only as offering a cheap substitute for steam power, but as lending a powerful aid to the amelioration of the condition of the working classes, and perhaps of becoming the means of removing the intolerable nuisance of smoke in large towns. This plan of water power which has been adopted at Grenock on a beautiful water fall of 512 feet high above the level of the sea, is capable of universal application throughout the island, and is rendered complete by the contrivance of a series of self-acting sluices adapted to every site and state of the weather, all the invention of the engineer who had the honour of first submitting the plan to the public. The success of the method at Rothsay, in the Isle of Bute, where it originated, induced a company of patriotic gentlemen in Grenock to lend themselves to the undertaking, and their works now, nearly finished, form one of the greatest wonders of art in the country. The rains collected from a number of barren hills in the neighbourhood of Grenock, are collected into a large natural reservoir at their base, and conveyed along the face of mountains, carried across deep ravines, and conducted along the edge of rocky precipices, in a gently sloping aqueduct about six miles long, to the brow of a hill surmounting the town; thence the water is led along in small aqueducts or lades to the mills, which are situated on the face of the hill, amounting to thirty-three in number, and from their various heights, being placed necessarily below each other, yielding a power arising from the extent of their falls equal to that of 2000 horses, as appears by the report of the company's engineer; and if certain improvements be afterwards made, they may be made to yield a power equal to that of 3000 horses, a mechanical power, far exceeding that of the great manufacturing town of Glasgow, and populous vicinity. The water collected into the great natural reservoir with some auxiliaries is drained from about 4890 acres of ground; it covers about 300 acres, in which the water stands about 46 feet deep, and it is capable of containing about 300 millions of cubic feet of water, or of discharging 600 millions of cubic feet annually; so that besides supplying the town of Grenock amply with water for culinary purposes to the amount of 50 millions of cubic feet annually, the reservoir can furnish 2464 cubic feet of water for 310 days, (the working days,) in the year; for the period of 12 hours a day. The most astonishing circumstance regarding this immense public undertaking, is, that they can afford to give their water so cheap to the people who take their mills, that the price of a horse's power is reduced to about the 20th part of what it would cost were it derived from steam. The expense of steam engines and fuel would, by the general adoption of this plan throughout the country, be entirely done away with. Coals, and many articles of consumption, would be rendered cheaper; the smoke of public works would be abolished in a more effectual way than by burning; and the health and morals of the lower classes, the last, but not the least important of the advantages, to be derived from it, would be improved by the removal of manufactories from confined situations in crowded towns, to airy and salubrious situations in the country. [*New Monthly Magazine, for* 1829.

Effect of Iodine upon Germination.

A SERIES of comparative experiments have been made by M. Canter, upon the germination and vegetation of plants moistened with water, solution of chlorine, and solution of iodine, the latter of equal density. The following are his conclusions: 1st, iodine is generally more effectual than chlorine in facilitating the germination of seeds; 2nd, iodine produces this effect by stimulating the germen of the seeds in the same manner as oxygen and chlorine; 3d, iodine is absorbed by the growing plant, but, by its affinity for hydrogen and the power of vegetation, is soon converted into hydriodic acid; 4th, the germination of seeds, which appear to have lost all vital powers, may frequently be excited by iodine. [*Bull. Univ.*

The Distance accomplished within one hour on the Liverpool and Manchester Rail-way.

IT has often been a subject of doubt whether the distance from Liverpool to Manchester could be travelled by a locomotive engine in the space of one hour. This extraordinary feat was performed on Tuesday morning, (Nov. 23,) by the Planet, one of Mr. Stephenson's most approved engines—the time occupied being only 60 minutes, of which two minutes were taken up in oiling and examining the machinery about midway. There were no carriages attached to the engine; the only persons on the tender being the engineer, the fireman, and Mr. Williams, the principal clerk in the Liverpool Crown street station. [*Manchester Mercury.*

Preservation of Iron from Rust.

A MASTIC or covering for this purpose, proposed by M. Zeni, and sanctioned by the Societé d'Encouragement, is as follows: eighty parts of pounded brick, passed through a silk sieve, are mixed with 20 parts of litharge; the whole is then rubbed up by the mullar with linseed oil so as to form a thick paint, which may be diluted with spirits of turpentine; before it is applied the iron should be well cleaned.

From an experience of two years, upon locks exposed to the air, and watered daily with salt water, after being covered with two coats of this mastic, the good effects of it have been thoroughly proved. [*Bull. d'Encour.*

To Readers and Correspondents.

The Committee on Publications, anxious to render this work as valuable as possible, have determined to offer a liberal compensation for original articles on the subjects to which this journal is devoted; and they accordingly invite men of science and mechanics to communicate their observations. Every article published will be liberally paid for.

All communications must be addressed, *free of expense*, to *Wm. Hamilton, Actuary of the Franklin Institute, Philadelphia.*

Meteorological observations for February, 1831.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain and snow.	State of the weather, and Remarks.	
		Sun rise.	2 P.M.	Sun rise.	2, P.M.	Direction.	Force.			
				Inches	Inches.			Inches.		
	1	31°	34°	29.30	29.40	W. N. W.	Blustering.		Cloudy.	Thawing.
	2	29	38	.90	30.00	W. W.	Moderate.		Clear.	Flying Cl'ds.
	3	26	32	30.00	29.70	S. E. S. E.	do.	.90	Cloudy.	Snow.
☾	4	25	24	29.40	.95	W. W.	Blustering.		Clear.	Clear.
	5	10	20	.65	.75	do.	do.		Clear.	Flying Cl'ds.
	6	8	20	.95	30.00	do.	do.		Clear.	Clear.
	7	13	24	30.05	.05	do.	Calm.		Cloudy.	Cloudy.
	8	15	30	29.95	29.95	do.	do.		Clear.	Cloudy.
	9	16	20	.95	.95	do.	Blustering.		Clear.	Clear.
	10	9	22	30.00	30.00	do.	Moderate.		Clear.	Clear.
	11	12	34	29.82	29.75	do.	do.		Clear.	Clear.
⊗	12	19	24	30.00	30.00	do.	do.		Flying cl'ds.	Sun eclipsed.
	13	12	20	30.00	.35	do.	do.		Clear.	Clear.
	14	6	22	.60	.60	do.	do.		Clear.	Clear.
	15	10	37	39.65	29.95	N. W. S.	do.		Clear.	Cloudy.
	16	40	46	11.95	.74	S. W.	do.	1.02	Rain.	Cloudy.
	17	34	36	.65	.75	W. W.	Blustering.		Clear.	Clear.
	18	15	24	30.10	30.10	do.	do.		Clear.	Clear.
☽	19	30	44	30.00	29.70	S. W. W.	Moderate.		Clear.	Clear.
	20	33	32	29.90	.30	N. W. W.	do.		Clear.	Clear.
	21	15	28	30.44	30.44	S. E. S.	do.		Clear.	Clear
	22	22	34	.15	.15	do.	Calm.		Cloudy.	Rain.
	23	42	40	29.30	29.30	S. S. W.	Moderate.	1.00	Rain.	Rain.
	24	27	31	.73	.83	W. N. W.	Blustering.		Clear.	Clear.
	25	21	30	.93	.90	N. W.	do.		Clear.	Clear.
🌕	26	24	37	30.05	30.10	W. W.	Moderate.		Clear.	Clear.
	27	27	42	.10	.15	W. E.	do.		Clear.	Clear.
	28	30	46	.15	.15	E. S.	do.		Clear.	Clear.
	Mean	21.46	31.11	29.91	29.97			2.92		

	Thermometer.		Barometer.	
Maximum height during the month,	46.	on the 16th and 28th,	30.60	on the 14th.
Minimum do.	6.	on the 14th, . .	29.30	on the 1st, 20th, and 23d.
Mean do.	26.28	. . . . .	29.94	

Water fallen in snow and rain, 2.92 inches.

Note.—During the solar eclipse the Thermometer in the shade fell 2 degrees. A meteorological register kept at Springfield, Clark county, Ohio, about lat. 39° 57′ N. and communicated to us, gives 17.66 for the mean temperature of the month of January at sun rise, which is nearly 3½ degrees lower than the mean at sun rise as given in our table for January.

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1831.

Safety Apparatus for Steam Boats, being a combination of the Fusible Metal Disk with the common Safety Valve. *By* A. D. Bache, Professor of Natural Philosophy and Chemistry in the University of Pennsylvania.

Among the causes which produce the explosions of steam boilers, no one stands more prominent, whether we have regard to the frequency of the explosions caused by it, or to their violence when they occur, than a defective supply of water within a boiler when in action. When the supply of water afforded to a boiler, is insufficient to compensate for the water which is converted into steam, the level of the fluid within is lowered; the boiler itself becomes heated, often intensely, and the steam partakes of this temperature without, from an insufficient supply of moisture to give the density corresponding to that temperature, having a corresponding elastic force. Of the existence of such a state of things within a boiler, the ordinary *safety valve* gives no indication, the tension of the steam within is not sufficient to overcome the weight with which the valve is loaded; it not only ceases to deserve the name of *safety* valve, but the opening of it, by hand, may be the very means of producing an explosion: for the escape of steam, thus permitted, relieves the water within the boiler from pressure; the fluid rises in foam; and being thrown into contact with the heated sides of the boiler, (or, as is supposed by some, being projected into the hot and unsaturated steam,) is flashed into steam, too considerable in quantity to find a vent through the valve, and of an elastic force sufficient to defy the controlling power of the materials used in the construction of the boiler. The raising of this valve is not necessary to the production of an explosion in the circumstances supposed, a supply of water suddenly introduced will produce the same dreadful effect. That such circumstances have frequently occurred, and have as frequently caused the results above described, is fully shown by the various authentic accounts of explosions on record.

The memoir of M. Arago, a translation of which is contained in the Journal of the Franklin Institute,[*] furnishes proofs of this fact; and the explosion of the boiler of the Chief Justice Marshall, during the last summer, has, I conceive, been fairly referred to the occurrence of similar circumstances.

The French Academy, when called upon, in 1823, to report to their government, the precautions to be used to prevent the explosions of steam boilers, satisfied of the insufficiency of the common valve to insure safety, required that in addition to two safety valves of the ordinary construction, one at the disposal of the engineer, the other under lock and key, there should be two plates of fusible metal covering apertures in the boiler; the one having its melting point at 18° F. above the temperature of the steam, which, according to the statement of the proprietor, made when his engine was established, was required to be used in the engine, the other at 18° above the fusing point of the first: the fusing point of each is thus, even in a high pressure engine, much below the temperature to which the boiler being heated there would be danger of explosion.[†] Now whether the steam be very elastic or not, so soon as it, or the boiler, arrives at the temperature requisite to fuse these plates, they melt, and the steam is discharged; this, too, below the limit of temperature at which such a discharge of steam would, according to the statement made in the former part of this article, be attended with danger.

These plates are made of alloys of bismuth, tin, and lead, in proportions varied according to the temperatures at which they are required to melt; by covering each with a piece of fine wire-gauze, it is prevented from swelling out by the effect of softening as it verges towards the fusing point.

Experience has shown that these plates can be relied on, confidently, to answer the ends proposed. In the stationary engine we should thus, by borrowing from our brethren abroad, be provided with a certain remedy against explosions caused by the circumstances we have endeavoured to explain, and also against the bursting of the boiler from an accumulation of steam within, should any accidental derangement of the common safety valve prevent its action. This device would be of the greatest value if applicable to steam boat boilers, for, being entirely without the control of the engineer, caution would be produced by the fact that any attempt to raise the steam above the proper pressure, or any inattention to the supply of water within the boiler, would be immediately made known to the captain and passengers by the noisy efflux of steam through the aperture opened by the melting of this tell-tale plate. If the plate were placed within sight of the passengers, the only means of an improper kind, to which the engineer could resort, to prevent its fusion, (sometimes practised in the stationary engine in France, according to M. Arago,) viz. keeping it cool by the application of water to its surface, would be entirely cut off.

---

[*] Vol. v. No. 6, and vol. vi. No. 1, 1830.

[†] Iron at a dull red heat has a temperature of 947° F. while steam of eleven atmospheres corresponds according to the late determination of Arago and Dulong to a temperature of 367.34° F.

The reason why this plate has been considered inapplicable to steam boat boilers, in general, is obvious; when the plate melts, all the steam must escape from the boiler, and the apparatus must cool before it can be replaced by a similar plate; this sudden desertion of the prime mover of the engine might, in certain cases, put the lives of the passengers in almost as great jeopardy as an explosion; instances, in an exposed navigation, will readily occur on reflection, such as a boat on a lee-shore, &c. In all cases such a desertion would be attended with very great inconvenience.

The remedy for this, and one which simplicity and consequent ease of application seem to recommend very particularly, will now be stated. If, as is hoped, this apparatus shall be found to remove every objection to the use of the fusible plate in the boilers of steam boats, it will insure the exemption of passengers from a portion at least of the dangers to which they are now so often exposed.

The method, which I would propose, is to combine the fusible plate, with the ordinary safety valve. Such a plate affixed to an opening of a proper size, in the boiler, as near as may be practicable to the highest line which is exposed to the direct action of the fire, is covered with a hollow cylinder, of a greater diameter than the aperture covered by the plate, the base of which presses upon the edges of the plate, while the top is arranged as the seat for a conical, or flat valve, of the ordinary kind; this valve will be habitually open, and when required to be used to prevent the escape of all the steam, will be pressed down, as is usual, by a weight acting by the intervention of a lever. This apparatus should be so placed upon the boiler as to be seen by the passengers, who are thus enabled to know that all is right, while the lever attached to the valve is in an elevated position, showing that the valve is raised from its seat; this lever is kept in its raised position, by a cross bar, supported on uprights, to which it is attached by a strong chain fastened by a padlock; the key of this lock being in the possession of the captain of the boat, the chain cannot be slipped, and of course the lever cannot be lowered, to close the valve, except through his agency. Suppose the steam or the boiler to become heated to the fusing point of the plate; it melts, steam issues through the small cylinder covering the plate, with a noise, which even at night would arouse the captain and passengers; if no danger will be incurred by loss of steam, and the consequent stoppage of the engine, such an escape should be allowed as a measure of precaution, though it is by no means one of necessity, since the limit of temperature producing fusion is much below that required for explosion. The alarm given, the steam gauge, should derangement of the safety valve have prevented its action, or, the usual practical observation upon the issuing steam, will show whether the fusion of the plate was caused by an accumulation of steam, or by the defective supply of water; this may be further tested by the gauge cock; should it prove that the water is below the usual level, a supply can be introduced without danger. A second plate, arranged in a similar manner to the first, fusible at say 20° F. above this, should be also provided, that the same means of safety may remain in case of accident to the first plate. The vigilance of the engineer would almost be insured by the use of these plates, from a knowledge that his inattention could not escape detection and its consequences. Passengers would be guarded against the results of carelessness, should it exist, and captains, as well as the public, would have the means of knowing accurately the value of those employed in the responsible station of engineers. The want of patronage which would inevitably attend an ill regulated engine, would soon correct evils now so formidable.

By the annexed figures, the method of arranging the fusible plate and safety valve, is shown in detail.

Fig. 1.

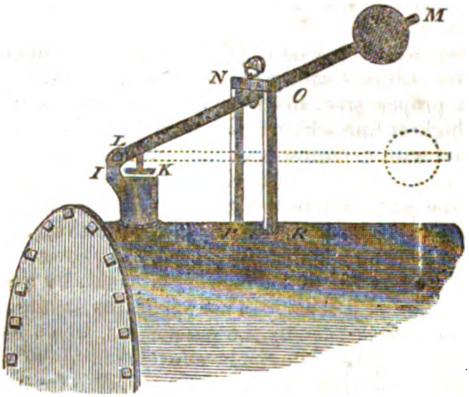
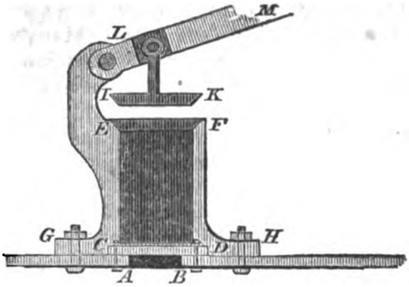


Fig. 1, represents an oblique view of part of a boiler with the safety apparatus attached. An unfavourable case, as to the space occupied by the apparatus, is taken, namely, that of a high pressure boiler required to work with steam of 150 lbs. bursting pressure, (ten atmospheres,) rendering it necessary to load the valve with rather more than 150 pounds.

Fig. 2, gives more in detail the method of arranging the fusible plate, &c. being a section of the apparatus. The area of the aperture closed by the plate is taken at 3 square inches, which is one half more than the area of the safety valve commonly used in a high pressure boiler of 3 feet in diameter by 10 feet in length. A, B, Fig. 2. is the aperture closed by the plate, C, D, of fusible metal, covered by a piece of wire gauze to prevent the plate from yielding as the temperature approaches its point of fusion. The plate is surrounded by a cylinder, E, F, G, H, of a greater diameter than the plate, terminated, above, by the valve seat E, F. Should the fusible plate, in giving vent to the steam, be thrown upwards, as an expression used by Arago in relation to it, gives reason to suppose, the valve should not be in the cylinder, E, F, G, H, but in one at right angles to it, so that the valve seat should not be vertically over the fusible plate. The valve, I, K, is represented of the usual form, though it may be questioned, whether this is the best which can be given: it is drawn in the position which it should habitually have, that is, so far raised from the seat as to give an opening for the escape of steam, equal in area to the valve.

Fig. 2.



To retain the valve in its position, the lever L, M, Fig. 1, is fastened to a bar of iron, N, O, (supported by the uprights N, P, and O, R, of the same material) by a chain, which is attached to N, O, at one extremity, and which passing round the lever, returns through an opening in N, O, to the top of the bar, where it is secured by a padlock. In the drawing the area of the valve, I, K, is 4½ square inches; this, at 150 lbs. to the square inch, requires a weight of 675 lbs. to press it down. The short arm of the lever is 1½ inch, the long arm 30 inches, the weight, T, is then about 33 lbs.

To raise the valve sufficiently above its seat, requires in the case figured, stanchions of 12.4 inches high. The whole apparatus thus occupies less than 3 feet in length, and 18 inches in height. The dotted lines represent the position of the valve when, after the fusion of the plate, it may have been closed.

On the importance of Hygrometric Observations in Meteorology, and the means of making them with accuracy.

The importance of hygrometric observations as forming a part of a meteorological journal, especially since we are now furnished with a hygrometer, which will inform us with certainty, not only of the relative quantity of vapour in the atmosphere, but of the absolute quantity, has induced me to offer a few remarks on this subject to the members of the Franklin Institute, for their consideration.

The object I have in view is to induce the Institute to use their influence to have meteorological journals kept in different parts of our wide extended country, on the same plan, and published in the Journal of the Institute monthly. Many persons, for their own private gratification, are now keeping very imperfect meteorological journals, who would feel a tenfold interest in the subject if they were informed by the Institute how to keep a much more perfect journal, with no more trouble, and at the same time contribute greatly to the public good. As many persons in the country may be willing, at the suggestion of the Institute, to keep a journal, who are not furnished with a Daniell's or Jones' Hygrometer, it may be useful to know how its place may be supplied. Any contrivance to obtain water in a common tumbler, cold enough to cause moisture to settle on the outside, will answer the purpose. During the summer months I have generally found pump water sufficiently cold, and in other months I have used ice or snow, and in very cold weather I have been obliged to have recourse to salt and snow. Any of these methods I consider preferable, both in simplicity and accuracy, to Daniell's or Jones', for by mingling waters of different temperatures, one above, and the other below the dew point, the exact point may be obtained to great nicety in a short time—whereas in using the evaporation of ether, the temperature is suddenly depressed below the dew point, sometimes to a considerable distance, and it requires much more time and skill to arrive at even tolerable accuracy.

However, when I could not procure ice or snow, I attached a small piece of muslin, or a thin piece of sponge, to one side of the bulb of a common thermometer, and poured a small quantity of ether upon it, carefully watching the naked side to see when the dew began to settle on it. When it settled very rapidly the thermometer had sunk below the dew point—but by wiping off the dew, and letting it settle again repeatedly, I could obtain a pretty accurate result. I have frequently compared these results with those I obtained by means of the cold water in the tumbler, and the agreement was very satisfactory.

In taking the temperature of the air, also, great care is required or errors will be committed. If the thermometer is surrounded by bodies either hotter or colder than the air, it will be affected by radiation—in the former case, it will give a temperature too high; in the latter, too low. In a clear calm evening, after sun set, I have known a thermometer placed near the ground and exposed to the open sky, to indicate from 8 to 12 degrees below the temperature of the air, which may be obtained nearly by swinging the thermometer rapidly round. So, during the day, if it is exposed to bodies heated by the sun, it will sometimes be several degrees warmer than the surrounding atmosphere which is not heated by radiation, but only by contact with solid bodies.

In cloudy weather, however, no such effects take place, for then the surface of the earth, and all other solid bodies, have their radiated caloric returned by the clouds, and consequently, they retain the temperature of the air. On cloudy nights the surface of the earth does not cool below the *dew point;* and, therefore, there is no dew. Even in clear nights, when the dew point is very far below the temperature of the air in the day, the surface of the ground does not sink in temperature to the dew point by radiation, and in such case also no dew is formed. I have observed in August, when the dew point has been as high as 76° Fah. when the temperature of the air during the day was above 90°, that but little dew was formed during the night, in the city of Philadelphia. No doubt more was formed in the country, where the surface of the ground was not exposed to radiation from hot brick walls. Be that as it may, I never saw dew begin to form on the grass in my yard, until its temperature had sunk to the dew point. Indeed, no reason can be imagined why it should settle on the grass before it is cooled by radiation to the dew point, any more than on a tumbler of water above the dew point. The phenomena are the same. The dew does not, in either case, fall through the air; but the vapour which is in the air, equally diffused by its own elasticity, when it comes in contact with solid bodies, cooled by radiation or otherwise, below the dew point, is deprived of so much of its caloric, that it is no longer able to maintain its elastic state, and is precipitated in the form of dew.

An objection may be urged against this theory, which at first appears plausible. It is known that dew does not appear under a shed, or even under a covering of thin muslin spread out at the distance of some feet from the ground, and therefore it is inferred that dew falls through the air from the upper regions. The true reason, however, is, that the temperature of the grass, or other bodies under the cover, does not fall to the dew point, the radiations being returned by the cover, which may easily be ascertained by placing one thermometer under the cover where there is no dew forming, and another in the grass, beyond the cover, where the dew is forming, when the difference will be detected. I have seen a difference of 8 or 10 degrees under the protection of a silk handkerchief, even when the air had a free passage between it and the ground.

Hence is demonstrated the great utility of even thin coverings over tender plants during clear nights in the spring, when the surface of the ground is likely to be cooled by radiation down to the freezing point. Plants so protected may be preserved, while those in their neighbourhood, unprotected, will be entirely destroyed.

Another argument against the theory of dew here proposed is, that the lower parts of the atmosphere do not contain vapour enough to form such heavy dews as sometimes appear—when more vapour is precipitated than is contained in a hundred feet of the atmosphere, in height, and it cannot be presumed that all this air comes in contact with the surface of the earth during a calm night when the dew is the greatest.

But this objection will have no weight, when we recollect what Dalton, I believe, first demonstrated, that aqueous vapour is not supported by the air, but by itself. Or, in other words, if the air should be suddenly annihilated, the aqueous vapour which is now diffused through it by its own elasticity, would neither sink upon itself, nor expand to a higher elevation; but its own elasticity would just be able to support its weight without further condensation. If now we suppose the lowest stratum of this vaporic atmosphere to be changed into dew, it is manifest that the whole vaporic atmosphere must descend; and this takes place, whether we suppose an atmosphere of common air or not: a longer time will be required to settle through the air than if there was none; but the ultimate effect is the same in both cases.

Indeed the hygrometer itself affords a most satisfactory proof, that aqueous vapour is not supported by atmospheric air; for it is no uncommon thing for the dew point to remain the same through the night—indicating that the density of the vapour continues unchanged; which could not be the case if vapour was supported by the air. For, as vapour is only about one-half the density of air, even when at its greatest density, unless compressed by art, it would rise rapidly through the air, from its levity, and leave the lower parts absolutely dry during the night, whilst no vapour is sent up from the ground to take the place of that which, by supposition, has ascended into the upper regions of the air. Surely it will not be said that vapour is sent up from the ground at the very moment dew is deposited there.

It must not, however, be supposed, that after vapour is condensed into cloud, it continues to press only upon the vapour below it. Part of its weight is then supported by the air, and the vapour below being relieved from part of its pressure, immediately upon the formation of the cloud, expands, and the dew point falls, as will be shown hereafter.

It is well known that the increase of aqueous vapour in the atmosphere, over a particular region, will depress the barometer, because this vapour is only about one-half the specific gravity of common air; but there are so many causes which produce a depression of the barometer, besides the rise of the dew point, or increase of moisture in the air, that a fall in the barometer is not an infallible sign of rain; yet I have no doubt that these two instruments united will enable the meteorologist to predict rain with absolute certainty, after a sufficient number of observations have been made to eliminate by induction a general law.

In the course of these observations, no doubt many curious facts will be discovered which the present state of science does not enable the philosopher to predict.

I will mention one here, which was so contrary to my anticipations at the time I first observed it, that for a while I doubted the possibility of ever arriving at any useful knowledge on the subject.

In the summer of 1829, there had been a very long period of dry weather, and I had been for many days taking the dew point very frequently, with much anxiety to discover the first indications of rain, when suddenly all my hopes were extinguished, by a fall in the dew point of several degrees in the course of half an hour—but to my great astonishment, in about 2½ hours, there came up one of the most violent showers I ever witnessed.

For several days previous to this, the barometer had been falling, and the dew point rising, (showing that the watery vapour was increasing,) whilst the temperature of the weather had remained nearly stationary..

I had been very particular in taking the dew point, so that I felt pretty confident no error was to be attributed to the observation; but still I was anxious to have an opportunity of witnessing a similar result.

Nothing similar was observed, though it might frequently have occurred, until the 16th of July, 1830, when I witnessed the following remarkable phenomenon. The weather had been very warm and dry for some days, the hygrometer being nearly stationary at 74°, for I had taken the dew point very frequently, and on the day of the present occurrence, I was sitting with the means of taking the dew point with me in my yard, when I perceived it suddenly sink 3 degrees, in a few minutes, and at the same time I observed a cloud forming immediately over my head, and in a few minutes more, the whole time not more than half an hour, a gentle shower of rain succeeded, hardly enough to wet the pavement.

Immediately after this shower the dew point rose again to its former elevation, 74°.

Not long after this I had the satisfaction of recording an observation of the same phenomenon, which renders it absolutely certain that sometimes, at least, the dew point sinks rapidly, and to a great extent, while it is raining in the neighbourhood.

From July the 16th to the 19th, the dew point gradually rose from 74° to 76°; it then remained stationary at that point, night and day, the mean temperature of the air being about 90° till the 22nd, at 5 o'clock, P. M. At 5, the dew point was 76°, as it had been for 4 days before; at 20 minutes after 5, the dew point was 70°; at 30 minutes after 5 it was 67°, and at 6 o'clock, it had fallen to 62°—that is, 14 degrees in one hour.

During all this time there was a great appearance of rain in the north—vivid lightning, thunder audible, and a strong wind blowing towards the cloud; and the temperature sunk 12 degrees. At 45 minutes after six, the wind had nearly ceased; but it did not begin to rain until 9, and rained but very little; but as I understood the next day, it had rained very hard between 5 and 6 within a few miles of the city—the barometer sunk $\frac{5}{100}$ of an inch, while the wind was blowing, but rose again when it became calm. The next morning the dew point had risen 9 degrees at 6 o'clock, and at 2, P. M. one degree more, being then within 4 degrees of its previous state.

It would not readily occur to any philosopher, à priori, that the dew point would fall just previous to the commencement of rain, or while it is raining in the neighbourhood; but after the fact is known, it is easily explained, on the principle first, I believe, demonstrated by Dalton, and afterwards discussed at large by Daniell—that aqueous vapour forms an atmosphere independent of the atmospheric air, and that these two fluids press only on particles of their own kind, and not on each other; consequently, as soon as it begins to rain over a small portion of country, as it often does in a summer shower, the equilibrium of the vaporic atmosphere is disturbed, a partial vacuum of vapour is formed over the region where it is raining, and the vapour from surrounding regions rushes towards the cloud where the pressure is less, diminishing the tension of the vapour in the regions around the cloud, and thus lowering the dew point. How so rapid a depression of the thermometer took place, I am not prepared to explain, but the wind towards the cloud was no doubt produced by the impulse of the aqueous vapour against the particles of atmospheric air. The only objection occurring to me which can be brought against this explanation, is, that the wind is known to blow in all directions from a falling shower, just at the borders of the shower. But this does not invalidate the explanation given above; for this effect is produced by the pressure of the drops of rain, which may be considered as exerting their whole force of gravity on the air beneath them, as soon as they cease to accelerate in their descent towards the surface of the earth; but the wind thus produced is known to extend not far beyond the skirts of the shower, and, of course, at the distance of two or three miles it may yield to the more extensive influence of the cause assigned above.

My object, however, at present being not to assign causes for phenomena, but to induce the Institute to use their influence to cause them to be observed and recorded, I proceed to mention another subject which I hope will engage the particular attention of all those who may hereafter keep a meteorological journal. That is, the evaporating point. By the evaporating point I mean the point to which the thermometer will sink by being surrounded by wet paper.

I some time ago instituted a course of observations on this subject, constantly comparing the evaporating point with the dew point, principally with a view to ascertain if any law could be established, by which the dew point could be known by having the distance of the evaporating point below the temperature of the air. In the first part of these experiments I took it for granted, as stated by Mr. Leslie, that the evaporating point is the same whether the thermometer is at rest in still air, or moved with rapid motion; but I have ascertained, by not less than fifty observations, made with a view to decide this one point, that this is not the fact; for the thermometer, covered with wet paper, invariably stands lower when moved rapidly, than when permitted to remain at rest in still air; sometimes to the amount of four degrees, and this too when the surrounding solid substances are known to be of the same temperature as the air, so that the thermometer could not be affected by radiation. The reason assigned by Mr. Leslie is so plausible that nothing but experiment could have led me to suspect its fallacy. He says that the motion produces a more rapid evaporation, and, of course, more cold, yet the latter effect is exactly neutralized by the warm air coming in contact with the thermometer. I have not yet been able to ascertain the law desired; but that such a law exists, I have no doubt—and if it could be ascertained, the trouble of obtaining the dew point would be entirely avoided; for the evaporating point can always be obtained with as much ease as the temperature of the air. The simplest method which I have been able to think of, to obtain the evaporating point, is to take an earthen pot unglazed, which I cause to be made for the purpose, and keep it filled with water, either where the air is still, as in a room, or where it is in motion, as you choose. The surface of the pot being constantly wet, the water within will always give you the evaporating point at any moment you may wish to make your observation. This much my observations will warrant me to say on this subject—that in high temperatures in summer, the evaporating point is nearer the dew point than the temperature of the air; and in low temperatures in winter, it is nearer the temperature of the air than to the dew point; consequently, there is some intermediate point where it stands half way between those two temperatures. Perhaps, also, the ratio may depend on the distance of the dew point from the temperature of the air. It would appear, that when the dew point is very far below the temperature of the air, the evaporating point recedes from the temperature of the air, and approaches the dew point.

By using the earthen pot to obtain the evaporating point, another very important inquiry may be answered without any other trouble than measuring the water used in replenishing the pot; i. e. how much water is evaporated from a humid surface in a given time?

Another subject which is at this moment exciting considerable interest among the philosophers of Europe, is, to ascertain the difference of temperature in the shade and in the sun, both with the bulb of the thermometer naked, and with one covered with black silk. Mr. Daniell thinks there is a much greater difference in high latitudes than in low. In Philadelphia, I have frequently found the naked thermometer rise forty degrees, and once fifty-six, above the temperature of the air, while the one covered with black was generally twelve degrees higher. Mr. Daniell also thinks that in high latitudes radiation after sun set cools the surface of the ground much more than in low latitudes. In this latitude, I have seldom found the temperature of the grass more than eight degrees below the temperature of the air. Whereas, Mr. Wells, who wrote the beautiful little essay on dew, says he has seen it as low as sixteen degrees below the temperature of the air. This would allow frost to occur in low situations when the temperature of the air during the night would not be below forty-seven degrees. Whereas, here, frost can hardly occur unless the temperature of the air falls below forty.

Capt. Scoresby mentions, as a strange and unaccountable phenomenon, that he has frequently observed, when sailing in high latitudes, the surface of the sea begin to be covered with thin ice, immediately after sunset, while the temperature of the air was still several degrees above the freezing point. When he called it unaccountable, he probably did not think of the principle of radiation. In Peru, where they have such heavy dews every night, the power of radiation must be very great, or, if not, the dew point must be but little below the temperature of the air during the day. Some traveller, I do not recollect his name, says he has seen frost in Africa in the torrid zone. Now I do not think this at all incredible. For the temperature in those regions must fall as far below the *mean* in the night, as it rises above the mean in the day. The mean temperature of the torrid zone is about 84°, and as loose dry sand is a very bad conductor, and a very good absorber and radiater of caloric, the surface of those wide extended deserts of sand in calm weather may easily be conceived to become fifty or sixty degrees above the mean during the day, and fall as far below it during the night, which would bring it down to the freezing point.

If farmers were acquainted with this one principle of radiation, they would avoid many evils to which they are now exposed. Who would plant an orchard in a hollow, who knew that cold air accumulates in hollows at night by running down the slopes leading to it, in contact with the surface of the ground cooled by radiation?

The time of taking the hygrometric observations is not important; it is not so, however, with the barometer. This instrument has four diurnal fluctuations. Just before sunrise, when the air is the coldest, and about two o'clock, when the air is the warmest, and, of course, neither contracting nor expanding by change of temperature, the barometer stands at its mean height; but sometime between sunrise and the hottest part of the day, when the air is expanding most rapidly by increasing heat, the barometer will stand at its greatest diurnal elevation, and some time after the hottest part of the day, when the air is suffering the most rapid contraction from cooling, the barometer will stand at its greatest diurnal depression. In the torrid zone, the point of greatest elevation is found by observation to be between nine or ten, A. M. and that of greatest depression, between five and six, P. M.* Now as it would be very desirable that two observations should be taken every day, I would earnestly recommend that between nine and ten in the morning, and five and six in the afternoon, be the time of taking observations—and if any observer wishes to take a third observation, or if any should be unwilling to take more than one per day, let two o'clock, P. M. be the hour.

I have now mentioned the most important parts of a meteorological journal, none of which can be omitted without materially diminishing its utility.

Those observers who have self-registering thermometers, will of course note the greatest cold and greatest heat of each day. The course and strength of the wind must not be forgotten; and those who have the means will mention the quantity of rain each month—and those who have the porous earthen pot, will note the evaporation.

If what has been said should induce even one faithful observer to record the dew point alone for one year, I shall consider myself amply rewarded for my trouble in making this communication.

For the sake of those who may not have access to books, and who may be curious on this subject, I have copied from Turner's Chemistry the following table, from which it will appear what proportion of the atmosphere in weight is vapour when the dew point is at the different temperatures from 32 to 80. For example, when the dew point is at 32, the pressure of the vapour alone is $\frac{2}{10}$ of an inch of mercury—that is, $\frac{1}{150}$ of the whole if the barometer stands at 30 inches. And if the dew point should rise to 80 degrees of Fah. which I believe it never does, for I have never seen it above 76; then would the pressure of the vapour alone be equal to one inch of mercury, that is, one-thirtieth of the whole atmospheric pressure.

---

* For a full explanation of this diurnal variation, see this Journal, vol. 1.

Temperature of dew point.	Weight of vapour inches.	Temperature of dew point.	Weight of vapour inches.
32	0.200	57	474
33	207	58	490
34	214	59	507
35	221	60	524
36	229	61	542
37	237	62	560
38	245	63	578
39	254	64	597
40	263	65	616
41	273	66	636
42	283	67	655
43	294	68	676
44	305	69	698
45	316	70	721
46	328	71	745
47	339	72	770
48	351	73	796
49	363	74	823
50	373	75	854
51	388	76	880
52	401	77	910
53	415	78	940
54	429	79	971
55	443	80	1.000
56	458		

A journal kept on the plan here recommended, during the month of April, will be given in the next number of this journal.

James P. Espy.

Philadelphia, March 31, 1831.

On the Strength of Pine and Spruce Timber.

A great portion of the annexed article, appeared in the last number of the American Journal of Science and Arts; it has been, at the request of the committee of publication, revised by the author. The note with which the article is now concluded, has been added, and the value of the table of results in page 232, increased by an extension of the calculations contained in the last column, and by the addition of some practical inferences drawn therefrom. [Com. Pub.

An account of some experiments made by order of Col. Totten, at Fort Adams, Newport, R. I., to ascertain the relative stiffness and strength of the following kinds of timber, viz: White Pine, *(Pinus strobus,)* Spruce, *(Abies nigra,)* and Southern Pine, *(Pinus australis,)* also called *(Long leaved Pine.*)—Communicated by* Lt. T. S. Brown, of the corps of Engineers.

The white pine and spruce were obtained from the eastern part of New England, and the southern pine from North Carolina. The specimens, which were well seasoned, were carefully selected, and were quite free from splits and knots. Three pieces of each kind of wood were taken, each piece being 9.389 feet in length, 2.75 inches in breadth, and 5.5 inches in depth. The distance between the points of support of the pieces under trial, was 7.1 feet. From one end of the beam, one point of support was 0.229 of a foot, or 2.75 inches distant, of course the other bearing point was 2.06 feet from the other end. All the above dimensions were chosen from their being proportional to those which will be actually required in the case to which these experiments refer. The load was applied by means of a strong platform, suspended from the beam, midway between the points of support. Bricks which had previously been accurately weighed, were used as weights. The deflections were measured by means of an index attached to the centre of the beam, and a scale so supported as to be independent of the rest of the system. The scale was isolated to avoid any irregular motions that might take place in consequence of the great weights it was necessary to employ; the supports, however, were so securely braced that no motions of the kind were observed. The scale was divided into parts, each of which corresponded to a deflection in the beam of 1-40th of an inch for one foot in length; as the distance between the points of support was 7.1 feet, it is easily seen that the length of one of these dimensions was 0.177 of an inch.

This deflection of 1-40th of an inch to one foot, was chosen as the unit of the scale, in consequence of its having been laid down by practical writers on the subject, as the greatest deflection of floor beams or joists, that should be allowed in practice.†

The bricks were slowly and carefully placed upon the platform by two assistants, who kept account of the number in an audible voice. As the beam was gradually bent by the increasing load, the moment when the index pointed to one of the divisions on the scale could be easily observed, at the same time the men, by their counting, gave information of the number of bricks on the platform, which being recorded opposite the deflection indicated by the scale, gave the weight producing that deflection. The men going steadily on, soon brought the index down to another division, when the number of bricks was again recorded, and so on until the deflection was as great as it was proposed to make it, or until the beam was broken; in either case the load was immediately removed from the platform, a new specimen substituted, the index re-adjusted to the zero of the scale, and the same operations repeated. By this method the number of useful observations during each trial, was greatly augmented without causing any additional trouble.

---

* It is proper to remark, that although there is no reason to doubt that the spruce used was *Abies nigra,* and that the southern pine was *Pinus australis,* yet it obviously may be very difficult to establish with certainty the botanical name of a kind of wood seen only in the form of *timber.* In the present instance, an attentive consideration of all the circumstances, has given great confidence that the names adopted above are correct, yet those familiar with the subject will at once perceive that in certain cases, the timber of *Abies alba,* might easily be taken for that of *Abies nigra,* and that it might also be difficult to decide between *Pinus mitis* and *Pinus australis.*

† See Tredgold's Carpentry, p. 30 to 46, and Franklin Journal, vol 3.

From the foregoing description, it will be seen that the loads were not allowed much time to act upon the beams, from which it follows that the weights producing the different deflections are rather overrated. With regard to the object for which these trials were instituted, this was a matter of no importance, as it could not affect the relation between the different kinds of wood, and upon making some experiments to ascertain the amount of error, it was found so small that it might with safety be neglected.

In the first trial, for instance, (Table [A,] specimen, No. 1,) the load of 2662 pounds, which produced a deflection of 4-40ths of an inch to a foot, instead of being immediately removed, was allowed to remain suspended for two hours and forty minutes, when it was found that the centre of the beam had sunk only 0.077 of an inch.

The foregoing observations, with a few explanatory remarks, will, it is hoped, render the following tables intelligible.

Table (A.) *Detailed Statement of Experiments to determine the relative Stiffness of White Pine, Spruce and Southern Pine.*

Deflection in parts of an inch to one foot.	Whole deflection in inches.	White Pine.		Spruce.		Southern Pine.	
		No. of specimen.	Weight in pounds, producing the deflection.	No. of specimen.	Weight in pounds, producing the deflection.	No. of specimen.	Weight in pounds, producing the deflection.
$\frac{1}{320}$	0.022	1	111	4	126	7	217
$\frac{1}{40}$	0.177	"	836	"	737	"	1187
$\frac{2}{40}$	0.355	"	1516	"	1295	"	2252
$\frac{3}{40}$	0.532	"	2125	"	1960	"	3266
$\frac{4}{40}$	0.710	"	2662	"	2683	"	4078
$\frac{1}{320}$	0.022	2	126	5	131	8	222
$\frac{1}{40}$	0.177	"	715	"	973	"	1195
$\frac{2}{40}$	0.355	"	1448	"	1729	"	2270
$\frac{3}{40}$	0.532	"	2074	"	2464	"	3274
$\frac{4}{40}$	0.710	"	2708	"	3119	"	4259
$\frac{1}{320}$	0.022	3	126	6	146	9	217
$\frac{1}{40}$	0.177	"	781	"	968	"	1143
$\frac{2}{40}$	0.355	"	1491	"	1815	"	2134
$\frac{3}{40}$	0.532	"	2125	"	2449	"	3037
$\frac{4}{40}$	0.710	"	2733	"	3098	"	3996

REMARKS.

Whole length of specimens in feet,	9.389
Bearing length in feet,	7.1
Breadth in inches,	2.75
Depth in inches,	5.5

In these trials, each specimen, upon being relieved of the load producing the greatest deflection, sprung back by the elasticity of the wood, until the centre came within about 0.046 inches of being as high as it was before the experiment commenced. This deflection of 0.046 inches, would have been still further reduced had more time been allowed; the elasticity of the wood, therefore, remained entire.

TABLE (B.) *Being a condensation of the results given in Table* (A,) *with other facts connected therewith.*

Kind of Wood.	Specific gravity.	Weight of a cubic foot.	Deflection in parts of an inch to one foot.	Whole deflection in inches.	Weight in pounds producing deflection.	Differences for each division on the scale of deflections.	Constant quantity (a) in the expression for stiffness, $\frac{B \times D^3}{a \times L^2} = W$.
White Pine.	.455	28.43	$\frac{1}{320}$	0.022	121		
			$\frac{1}{40}$	0.177	777	777	$a=0.0116811$
			$\frac{2}{40}$	0.355	1485	708	$a=0.0061119$
			$\frac{3}{40}$	0.532	2108	623	$a=0.0043056$
			$\frac{4}{40}$	0.710	2701	593	$a=0.0033603$
Spruce.	.490	30.63	$\frac{1}{320}$	0.022	134		
			$\frac{1}{40}$	0.177	892	892	$a=0.0101751$
			$\frac{2}{40}$	0.355	1613	721	$a=0.0056269$
			$\frac{3}{40}$	0.532	2291	678	$a=0.0039617$
			$\frac{4}{40}$	0.710	2966	675	$a=0.0030601$
Southern Pine.	.872	54.50	$\frac{1}{320}$	0.022	218		
			$\frac{1}{40}$	0.177	1175	1175	$a=0.0077244$
			$\frac{2}{40}$	0.355	2218	1043	$a=0.0040921$
			$\frac{3}{40}$	0.532	3192	974	$a=0.0028434$
			$\frac{4}{40}$	0.710	4111	919	$a=0.0022078$
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*

REMARKS.

In the expression for stiffness, $\frac{B \times D^3}{a \times L^2} = W$, (col. *h*,)

(B) represents the breadth in inches,
(D) the depth in inches,
(L) the bearing-length in feet, and
(W) the weight.

The constant number (a) has been calculated for the different deflections from one-fortieth of an inch for one foot to four-fortieths, inclusive, but in practice the deflection should, generally, not be allowed to exceed one-fortieth of an inch for each foot in length. In works on this subject, it is laid down as a rule, that if we wish to give a deflection double, treble, or quadruple, the ordinary deflection of one-fortieth of an inch to one foot, we must divide the constant (a,) determined for a deflection of one-fortieth of an inch, by 2, 3, or 4, for the new constant required. We are enabled by this table to make a comparison between the results thus obtained, and those arising from direct experiment. For instance: for White Pine, the constant number for one-fortieth of an inch deflection, is 0.0116811, which divided by 2 for a deflection of two-fortieths, gives 0.0058405, whereas in this table, the constant for a deflection of two-fortieths of an inch is 0.0061119. The difference is 0.0002714; with a greater deflection, the difference between the result of the two methods would be greater.

TABLE (C.) *Experiments to ascertain the circumstances of fracture, giving the aggregate of the results for each kind of wood.*

Kind of Wood.	Deflection in parts of an inch to one foot.	Whole deflection in inches.	Deflection at moment of FRACTURE.	Whole deflection in inches at moment of FRACTURE.	Weight in pounds producing deflection.	Weight producing FRACTURE.	Differences for each division on the scale of deflections.	Comparative strength of white pine, spruce and southern pine, white pine being unit.	Value of the constant quantity (c) in the expression for *strength*, $\frac{B\times D^2\times c}{L}=W$.
White Pine.	$\frac{4}{40}$	0.710			2656		664		
	$\frac{5}{40}$	0.887			3217		561		
	$\frac{6}{40}$	1.065			3745		528		
	$\frac{7}{40}$	1.242			4062		317		
	$\frac{8}{40}$	1.420			4266		204		
	$\frac{9}{40}$	1.597			4390		124		
	$\frac{10}{40}$	1.775			4560		170		
	$\frac{11}{40}$	1.952			4664		104		
	$\frac{12}{40}$	2.130			4775		111		
	$\frac{13}{40}$	2.307			4833		58		
	$\frac{14}{40}$	2.485			4893		60		
			$\frac{16}{40}$	2.840		5189		1.000	$c=443$
Spruce.	$\frac{4}{40}$	0.710			2806		701		
	$\frac{5}{40}$	0.887			3505		699		
	$\frac{6}{40}$	1.065			3955		450		
	$\frac{7}{40}$	1.242			4443		488		
	$\frac{8}{40}$	1.420			4705		262		
	$\frac{9}{40}$	1.597			4877		172		
	$\frac{10}{40}$	1.775			5051		174		
	$\frac{11}{40}$	1.952			5185		134		
	$\frac{12}{40}$	2.130			5324		139		
	$\frac{13}{40}$	2.307			5441		117		
			$\frac{15}{40}$	2.662		5646		1.101	$c=482$
Southern Pine.	$\frac{4}{40}$	0.710			3698		924		
	$\frac{5}{40}$	0.887			4611		913		
	$\frac{6}{40}$	1.065			5487		876		
	$\frac{7}{40}$	1.242			6268		781		
	$\frac{8}{40}$	1.420			7049		781		
	$\frac{9}{40}$	1.597			7593		544		
	$\frac{10}{40}$	1.775			8033		440		
	$\frac{11}{40}$	1.952			8429		396		
	$\frac{12}{40}$	2.130			8578		149		
			$\frac{14}{40}$	2.485		9237		1.780	$c=788$
	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*

Remark on the foregoing Table.

In the expression for strength $\frac{B\times D^2\times c}{L}=W$, column i, the letters B, D, L, and W, have the same signification as in Table (B.) (See note at the conclusion of this article, page 236.)

TABLE (D.) *Relative stiffness of White Pine, Spruce and Southern Pine, at different deflections, White Pine at each particular deflection being taken as the unit.*

RATIOS OF STIFFNESS.			
Deflection in parts of an inch to one foot.	White Pine.	Spruce.	Southern Pine.
$\frac{1}{320}$	1.	1.107	1.801
$\frac{1}{40}$	1.	1.148	1.512
$\frac{2}{40}$	1.	1.086	1.493
$\frac{3}{40}$	1.	1.087	1.514
$\frac{4}{40}$	1.	1.098	1.522
$\frac{5}{40}$	1.	1.078	1.532
$\frac{6}{40}$	1.	1.056	1.465
$\frac{7}{40}$	1.	1.096	1.543
$\frac{8}{40}$	1.	1.102	1.652
$\frac{9}{40}$	1.	1.110	1.729
$\frac{10}{40}$	1.	1.107	1.761
$\frac{11}{40}$	1.	1.111	1.807

Observations on the foregoing Tables.

Although table (B) embodies all the information given in table (A,) it is nevertheless thought of some importance to present the results actually obtained in the experiments, the mind is thereby better satisfied, and in this instance the general agreement of those results will tend to inspire confidence. Table (C) contains the average of the results of the original experiments under that head, which were found to harmonize with each other in the same general manner as those of table (A.) It may be remarked with reference to the weight producing fracture, that the results given in table (C) are slightly overrated, in consequence of the small time occupied in making the experiments; this, however, is no practical disadvantage, as in calculating the strength of timber from algebraical formulæ, large allowance must always be made to provide against accidental defects.

It was observed in all these experiments, that the failures of the wood began at the top. The upper fibres, for rather less than half the depth of the beam, were gradually crushed and broken off in the bending of the specimen, and at last when no more weight could be supported, a fracture suddenly took place, the lower fibres being drawn asunder. It seemed that the bending took place more in consequence of the crushing of the upper fibres than the extension of the lower ones. The fractures were not sufficiently regular to permit any comparison to be drawn as to the relative number of fibres crushed and drawn asunder in the different kinds of wood.

The results in columns (*g*) of tables (B) and (C,) indicate the weights which were required to bend the specimens through an additional division on the scale of deflections. If the deflections were always as the weights producing them, it is evident that all the differences in columns (*g*,) would, for the same kind of wood, be equal. It is easily seen, however, as might have been anticipated, that after having passed with considerable regularity through the first two or three divisions, the deflections begin to increase in a much greater ratio than the weights. From this cause it is very important that in experiments on the stiffness of timber, small deflections only should be tried, and that those deflections should be accurately measured.

It may be seen that the weights producing deflections of 4-40ths of an inch to one foot are less in table (C) than in table (B,) the reason for which is, that the stiffness of the wood was diminished by the first trials.

A circumstance of a practical nature connected with these experiments, deserves to be noticed, as it may possibly have modified the results in a slight degree. It was necessary in suspending the load from the beam, to adopt some precaution to prevent the iron band connected with the platform, from cutting into the wood, and thereby crippling the timber. The annexed sketch will indicate more clearly than any description, the means that were employed.

Fig. 1.

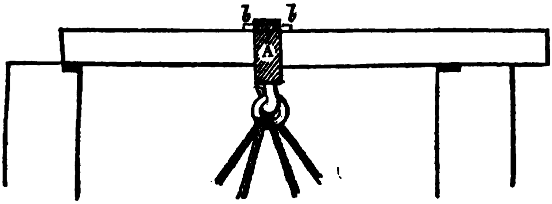
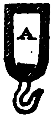


Fig. 2.



(A,) Figs. (1) and (2) is a strong iron collar, three inches wide and half an inch thick, embracing the specimen under trial, from which, by means of the hook below, the platform containing the load was suspended: (*b*) represents a bar of iron 2.75 inches wide, six inches long, and half an inch thick, resting upon the wood underneath the collar.

It is therefore evident that the load was not applied precisely at the centre point, but upon a surface six inches long, the centre of which corresponded with the centre of the bearing length.

In every instance when the beam was broken, the fracture took place at one end of the bar (*b*), and therefore at the distance of three inches from the true centre.

In the trials relating to stiffness, tables (A) and (B,) it is not supposed that this bar modified the results in any appreciable degree, that is to say, the results given in these tables may, without any sensible error, be considered as having been obtained by applying the weight precisely at the centre. The case is different, however, with the results given in table (C); but since the error, whatever it may be, (and that it must be small is evident,) does not affect the comparison of the woods, it is of no consequence as to the particular object had in view.

Some of the *general* inferences to be drawn from the foregoing experiments, are:—

1st. That within certain limits, which extend much further than it is proper in practice to suffer wood to bend, the deflections are very nearly as the weights producing them; see table (B,) column (*g.*)

2nd. When we have a given weight to sustain, so that the deflections shall not exceed 1-40 of an inch to one foot, other circumstances being equal, ten beams of southern pine are equivalent, nearly, to thirteen of spruce or to fifteen of white pine. When the deflections to which the timber is exposed are very much less than 1-40th of an inch to one foot, or when we merely wish to guard against fracture, the disproportion between southern pine and the other woods, is much greater; see 2nd and 1st lines, table (D) and column (*h*,) table (C.) It was to obtain the results given in this paragraph, that these experiments were instituted. [*Silliman's Journal.*

Note by the Author.

For the benefit of those who do not understand the use of algebraic formulæ, it may not be amiss to translate into ordinary language the expressions for stiffness and for strength found in tables (B) and (C.)

The expression for stiffness $\frac{B \times D^3}{a. \times L^2} = W$, (Table B,) amounts, in common language, to the following

Rule.

1. Multiply the breadth, (in inches,) three times by the depth, (in inches.)

2. Multiply the constant number (*a*) twice by the bearing-length (in feet.) This constant number (*a*) is to be found in Table (B,) opposite the name of the kind of wood, and particular deflection desired.

3. Divide the result of the first operation by that of the second, and the quotient is the weight, in pounds, which may be placed on the centre of the beam, so that its deflection shall not exceed the deflection desired.

Example 1.—Required to find the weight which may be placed on the centre of a white pine beam, the distance between the supports near its ends being 20 feet, its breadth 6 inches, and its depth 12 inches, so that the deflection shall not exceed one-fortieth of an inch for every foot of its length, or, in other words, so that the whole depression at its centre shall not exceed twenty-fortieths, or half an inch.

In Table (B) we find the number (*a*) for a deflection of one-fortieth of an inch in White Pine to be 0.0116811. Then, 6 inches (the breadth,) multiplied three times by 12 inches, (the depth,) gives - - - - 10368 (1st.)
0.0116811 multiplied twice by 20, (the length in feet,) gives - - - - 4.672 (2nd.)

Divide the first by the second, and we have - 2219 for the weight, in pounds, which may be placed at the centre of the beam.

Example 2.—Suppose that a stick of Southern Pine, 12 inches deep, and having a bearing-length of 15 feet, is required to support at the centre a weight of 16891 pounds, how broad must it be, so that the deflection shall not exceed two-fortieths, or one-twentieth of an inch to a foot; that is, so that the centre shall not be depressed more than fifteen-twentieths, or three-fourths of an inch.

In this case, as we wish to obtain the breadth of the beam, we must multiply the weight, in pounds, twice by the length in feet, and that product by the number (*a*) and divide the result by the depth, (in inches,) multiplied twice by itself. We find from Table (B,) the number (*a*) opposite the deflection of two-fortieths of an inch in Southern pine, to be 0.0040921. Then 16891 multiplied twice by 15, and by 0.0040921, gives - - 15552 (1st.)
12, the depth in inches, multiplied twice by itself,
gives - - - - - - 1728 (2nd.)
The first divided by the second, gives - 9 inches.

The beam must then be 9 inches broad to fulfil the condition required.

The expression for the strength of timber $\frac{B.\times D^2.\times c}{L} = W$, (Table C,) which expresses the resistance to fracture, may be translated into the following

Rule.

Multiply the breadth, (in inches,) twice by the depth, (in inches,) and the product by the constant number (*c*) for that particular kind of wood. The result thus obtained divided by the bearing-length, (in feet,) gives the weight, in pounds, which will just break the beam.

Example. Required to find the weight which a beam of Southern Pine, 20 feet long between the supports, 10 inches broad, and 12 inches deep, will support at the centre, without breaking.

In this case the number (*c*) is 788 (Table C, col. *i.*) Then 10 inches, (the breadth,) multiplied twice by 12 inches, (the depth,) and the last product by 788 (*c*) gives - 1134720 (1st.)
Divide this by 20, (bearing-length in feet,) and
we have - - - - - 56736 pounds,
the weight required to break the timber.

It must be borne in mind that these results are true only for the finest qualities of well seasoned timber. Green timber is neither as stiff nor as strong as that which has been seasoned, and deductions must be made to guard against defects.

These illustrations will fully exemplify the value, to practical men, of accurate experiments upon the stiffness and strength of timber. "To know the resistance which a piece of timber offers to any force tending to change its form, is one of the most important species of knowledge that a carpenter has to acquire; and to be able to judge of the degree of resistance from observation only, even in common cases, requires nothing less than the practice of a life devoted wholly to carpentry. Besides it is a species of knowledge that is confined to the person who has obtained it, and dies with him. It is a feeling of fitness that cannot be communicated, nor yet described; nevertheless it is a feeling that every thinking, practical man is sensible he possesses. I am far from having a wish to banish the nice observation that gives birth to this feeling; because it is more desirable that it should be encouraged than suppressed: but there are cases where it fails; that is, when the magnitude of the object is beyond the range of ordinary practice; and when new combinations are attempted. In such cases the laws of the resistance of solids should be referred to, even by the expert practical man; and he will be better able to judge of their correctness if he finds them, in common cases, to give results that agree with those he has drawn from practice."* In Tredgold's Carpentry, and other similar works, may be found the constant numbers (*a*) and (*c*) for nearly all the kinds of wood useful in the arts; but besides that these numbers are in many instances calculated from insufficient experiments, most of the specimens used in the trials were of European growth, and, of course, the results obtained are inapplicable to American timber, though bearing the same name. It is much to be desired that numerous and accurate experiments be made, in this country, by those having the requisite zeal and opportunities; our architects will then know with certainty the qualities of the different kinds of wood they are using, and instead of working at hazard and in the dark, as they now too often do, they will be guided by the sure light of practical science to certain and definite results. If these experiments contribute, ever so little, to the attainment of so important a result, the object of their publication will be fully accomplished.

On the Straight Edge.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

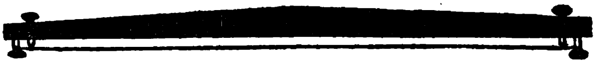
Mr. Editor,—The difficulty and expense of making Straight Edges of considerable length, render any improvement in these indispensable tools a desideratum. The usual mode taken to make them accurate, is to secure together three thin bars of steel, and file them together to a uniform breadth, or as nearly so as practicable; then to separate them, and compare their edges respectively with each other: if when the ends are reversed and the edges again compared, they should correspond, they may be considered, for all practicable purposes, perfect.

This method being tedious and expensive, good straight edges of more than three or four feet in length are rarely to be met with, and highly prized when obtained. When they are required of greater length, a serious difficulty occurs in their use. The slightest lateral deviation from a straight line will, of course, affect the accuracy of the instrument; consequently, the bar must be made so inflexible that it will not bend when inclined to the side, and, of course, becomes a cumbrous tool. To remedy the last difficulty, an ingenious mechanic of this city constructed one of a cylindrical form, of iron cast hollow, about two inches diameter, and turned so thin that its weight was not objectionable, while its form rendered it inflexible to a considerable length, and in use was found quite as convenient as the flat straight edge. The cylinder being first turned in a slide lathe, and then ground with emery in a lead cap made to fit the circle, produced an instrument of great accuracy, at trifling expense.

---

* Tredgold.

We have been led to these remarks by observing at a workshop in this city, a straight edge so simple and cheap, that we almost doubted its novelty, though we confess such a one never before came under our notice.* It was made of steel harpsichord wire, stretched upon the edge of a board or frame and kept tight by screws—set screws were placed at each end which passed to the under side of the wire, and suffered it to touch the work or not, at the option of the workman.



The instrument we saw was twelve feet in length, and was stretched to the whole extent of the lathe shears which were finishing by it. The wire being too fine to exhibit the inequalities of the work to the eye, the operator set the points of the screws so far beneath the wire that it should only touch at the more prominent places, and then on passing along the work, discovered, by depressing the wire, where it touched and where it did not. The trouble attending the use of this instrument made it more convenient to use a wooden straight edge for roughing down the work, but its great accuracy made it very valuable in finishing.

We have often seen fine thread fastened to a wooden bow for the same purpose, but such a tool can only be depended on when held to the side of the work, obliging the operator to turn it over whenever he wanted to examine his progress, (an operation inconvenient when working a heavy casting,) because the thread curved by its own weight. No such difficulty is experienced in using the above, as its tenacity is so great, that it will bear a strain sufficient to keep it perfectly straight. M.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN DECEMBER, 1830.

With Remarks and Exemplifications, by the Editor.

1. For an improved *Grist Mill*, called the 'Pressure or Weighted Grist Mill;' John Ambler, jr. and David C. Ambler, Berlin, Chenango county, New York, December 6.

This is a Grist Mill intended to operate with small stones; in its general construction it resembles some of the other portable grist mills, for which patents have been obtained. The particular difference between it and others, could not be pointed out without a minute investigation, in which few persons would feel interested. We give the claim, which is as follows.

---

* It is not new, but has been used for testing the straightness of gun barrels. —Editor.

"The parts to which we lay claim as original, is the weighting of the upper stone with heavy articles, as iron, lead, stone, &c. The manner in which the safety rod, or damsel, is made, which allows it to be oiled at the top, and its resting on the balance rim in such a manner as not to interfere with the balancing of the upper stone; and the using its damsel as a protecting rod, to protect the upper stone from raising farther than it is raised by the bridge tree."

We have seen samples of the flour manufactured by it, which appeared to be equal to that made in the larger mills, although the stones used were not more than 24 inches in diameter. Whether this arose from the mill being more skilfully made and managed, or from any inherent superiority in its structure, we are unable to say.

---

2. For a machine for *Making Window Sashes;* Charles Thompson, Poughkeepsie, Dutchess county, New York, December 6.

It is proposed to combine together in one frame, 1st, a machine for sawing off and slitting the boards; 2nd, a machine for planing, striking, and rebating; 3d, a machine for sawing the tenons; 4th, a machine for mortising; 5th, a machine for sawing munnions and dovetails; 6th, a coping plane; 7th, a grooving machine.

The sawing is to be effected by circular saws. The planes are to be moved backward and forward by a crank motion, and the machinery generally is to be driven by drums and straps. "The improvements claimed, are the before described machines, when combined, for making window sashes."

In the separate machines there is little or no novelty, and judging by the claim, it would appear that the patentee is aware of this, as he does not claim any of the particular parts of either of them. There are already machines in successful operation for the same purpose with the foregoing; and although the present patentee might defend the particular combination described, provided neither of the individual machines interfere with existing claims, a patent, based upon the mere arrangement of parts, without a claim to actual novelty in any of the individual parts, does not appear to us to stand very securely; as an ingenious workman can, in most cases, very readily devise another arrangement, which shall be equally efficient, and have an equal claim to novelty.

---

3. For a machine for *Thrashing and Winnowing Wheat* and other small grain; Thomas Burrall, Geneva, Ontario county, New York, December 6.

The thrashing is to be effected in the ordinary way, by means of a cylinder and hollow segment. There are to be cast iron side plates to sustain the cylinder and segment. A rake, screen, and fan wheel, are used in the winnowing or cleaning.

The most convenient mode of driving this machinery, we are told, is by horses, or oxen, upon an inclined wheel. This wheel the patentee says he has "improved by a new mode of graduating and governing its motion." This is effected, if we understand the description, by altering the inclination of the wheel, or the position of the animals. But of this part there is no drawing, and the explanation is not very clear. The claim is to "the *cast iron side plates* for the purpose above set forth. The arrangement and combination of the rake, racks, and fan, for separating the grain from the straw and chaff, in the manner described, and the swing bar for governing the inclined wheel by which the power is applied."

---

4. For a machine for *Washing Clothes;* Alvan Foote, Granville, Licking county, Ohio, December 7.

The cloths are to be put into a revolving barrel, closed by a door. The barrel is to be turned by a crank in the ordinary way. The gudgeon upon which it turns at the opposite end is hollow, for the admission of steam. A boiler, furnished with a safety valve, is to supply the steam through a tube passing into the hollow gudgeon. We are not told any thing about a stuffing box at the junction of the two, to prevent the escape of the steam, *but this is a thing of course.*

"What I claim as my invention, is the mode of introducing the steam into the cylinder, through the gudgeon and pipe, as before described, when applied to machines for washing clothes."

In addition to the calamitous explosions on board of steam boats, we may shortly hear of the blowing up of washing machines, and the maiming of the poor old women who are to become engineers. The main security in this machinery, will be the difficulty of rendering the junctures steam tight; in which case the steam and the washerwoman may escape, uninjuring and uninjured.

---

5. For a *Bed Key;* Judson Blake, and Daniel Cushing, Providence, Providence county, Rhode Island, December 14.

This bed key is to be of cast iron or other metal, and is to have two, three, four, or more, arms, each having a socket in it of different sizes, to fit different screw heads. There are five different forms represented, in which the key may be made, and fifty might be given.

"The superior utility of this improvement over the common bed key, consists in its fitting screws of a greater number of sizes, and in its being made of such materials, and in such a manner, as to cost less than the key now in use."

To be able to trace the successive steps by which an inventor of some complex machine arrives at the final result, would, in many cases, be highly interesting, but the task would be one of great difficulty. Although the invention before us, is not one of great complexity, it would still be no easy thing to assign to each of the heads which have been engaged in maturing the plan, their respective shares of the merit due to them.

Would not a common iron brace, with two or three bits, having sockets of different sizes, answer the purpose intended better than the patented machine? We think it would, and are very sure that it would not interfere with this *new and original discovery.*

---

6. For an improvement in the art of heating or warming rooms, dwelling houses, offices, hot houses, churches, or any other public or private building of any description, or size, by means of a machine, apparatus, or implement, which he denominates a "*Portable Steam and Hot Water Stove;*" Thomas Green Fessenden, Attorney at Law, Charlestown, Middlesex county, Massachusetts, December 14.

(See specification.)

---

7. For an improvement in machinery *for Sawing Veneers;* Caleb B. Burnap, city of New York, December 14.

This machinery is designed to enable a circular saw of small diameter to saw veneers from wide logs. The circular saw is to be constructed like those commonly used for sawing veneers; that is, it is to have one fair face, and is supported on the opposite side by a shaft running in collars, like a collar and mandril lathe. The saw and its shaft is to be fixed in a vibrating frame, which will carry the saw up and down to the distance required for the width of the log to be cut. The veneer is to be turned off, out of the way of the saw-shaft, in the usual manner. The claim is to "the application of the vibratory motion to one or more circular saws for sawing veneers from a plain surface."

The mode of giving the vibratory motion is by the application of a crank and pitman. This, however, we need not describe, as the particular manner of doing this, which the patentee gives, forms no part of his claim.

---

8. For a *Machine for Planting of Corn,* or corn and peas, in the drill form; Reuben Coffey, Burke county, North Carolina, December 14.

This planting machine bears a strong resemblance to many others. The general form of it is somewhat like that of a plough. There is a coulter in front to open a furrow; behind this is a wheel, which runs upon the ground, and has projecting spikes to insure its revolving. The seed is put into a hopper, and is caused to drop into the furrow, in proper quantity, by the action of the wheel. The earth is closed upon the seed, by a scraper, or pins, behind the wheel.

In the principle of the machine there is no novelty. There is no claim made, and to the drawing there are no written references.

9. For a *Portable Machine for conveying Animal Power of any kind to Machinery;* Joseph C. Gentrey, city of Philadelphia, December 14.

This may stand among the many extraordinary patents obtained for things, the novelty of which neither the patentee, or any other person, can point out. A lever, or sweep, to which a horse or other animal is to be attached, is to turn a vertical shaft. Upon this shaft is to be a cog wheel like that commonly employed; the cog wheel is to drive a pinion, which pinion turns a band or strap-wheel, eight feet in diameter. Here we are compelled to end our description, because we have given the whole; and the whole claim is to "the above described machine for conveying power of any kind to machinery."

---

10. For an *Improvement in Distilling;* Thos. Gallaher, Liverpool, Perry county, Pennsylvania, December 14.

This is a steam distilling apparatus, the novelty of which must be judged of by those who know what has been already done in this way, after reading the claims of the patentee.

"What I claim as my invention, is the method of having an opening, or openings, passing through the boiler, for causing the fire to return through the boiler before it passes off into the flue, when applied to distilling. I also claim the method before described of causing the steam to return back from the doubler into the heater, and from thence through the mashing tub; and likewise placing the doubler apart from the other parts of the apparatus."

---

11. For an improvement in the mode of *Extracting Oil from Cotton Seed;* Gideon Palmer, Montville, New London county, Connecticut, December 14.

"The seed being hulled in the usual way, is ground in an oil mill like flax seed. About three quarts of water are mixed with about 75 pounds of seed. The flour is then put into an iron cylinder and heated over a fire until steam is produced. It is then put into my patented oil press, and the oil extracted.

"The effect of this process is to extract much more oil than in the common mode of pressing the seed with the hull on. The oil cakes are also made much more valuable.

"What I claim as my own invention is the before described mode of extracting oil from cotton seed with the hull off, and not in the usual way with the hull on." "GIDEON PALMER."

By turning to Vol. 3, No. 5, p. 260, it will be seen that on the 21st of January, 1829, Francis Follet, of Petersburg, Virginia, obtained a patent for hulling cotton seed, in order to prepare it for the oil press; and at p. 141 of our last volume, a letter addressed to the patentee, from Gen. Williams, of South Carolina, furnishes much information on the application and utility of this invention. The "mode of extracting oil from cotton seed with the hull off, and not in the usual way with the hull on," is not now, therefore, a legitimate subject of claim.

We do not suppose that Mr. Palmer means to limit his claim to the pressing of cotton seed in his patented oil press, but that he would consider the Dutch pestle and wedge, as an interference with his right. Neither the moistening or the heating of seeds for the purpose of extracting their oil, are new. The keeping to the particular proportions named, may be so.

---

12. For an improvement in the *Press for pressing oil, cotton, tobacco,* and other substances requiring great pressure; Gideon Palmer, Montville, New London county, Connecticut, December 14.

This press is to be operated upon by the gravity of water. At the lower part of the press, a vat, or cistern, is constructed, which is capable of being filled with water. Within this is placed a second cistern filled with water, and of about one-half of the depth of the former. When the outer vessel is filled, the inner one will float within it, and when the water is drawn off from the outer vessel, the inner will tend to descend with its load of water, which in the press described, would amount to nine tons. An upright shaft ascends from the inner cistern, to which it is firmly attached and secured by braces. This shaft operates upon the arms by which the pressure is to be made. The principle of the action of these arms is that of the toggle joint; each arm presses outwards against the sides, or cheeks of the press.

The seed, or other article to be pressed, is placed between boxes, or gripes, at each side. Against these boxes, or gripes, followers are forced by means of the jointed arms, which when the shaft is up, and the press out of action, rise, so as to form an angle with each other, and when in full action stand in the same horizontal line. The upper end of the shaft is in the form of a wedge, with its narrowest end downwards. This wedge stands between the inner ends of the arms, and operates, with their own descent, to force their opsite ends out upon the article to be pressed.

The press boxes, or gripes, between which the seed is to be pressed, "are made of bars of wrought iron, lined with sheet iron, bolted and keyed together at the corners, in such a manner, as to open and shut to receive and discharge their contents with ease and facility."

"What I particularly claim as a new and useful improvement in the oil press is, first. The application of a weight of water to press any substance requiring pressure, in the manner above described. Secondly. The formation of the press boxes, and application of these press boxes afore described to the ordinary screw and lever press. Thirdly. The wedge as applied in the press above described."

---

13. For a mode of making or *manufacturing Shoes and Boots,* called the Farmer's double improved boot and shoe sole;

Moses Pennock, Marlborough, Chester county, Pennsylvania, December 14.

(See specification.)

---

14. For an improvement in making *Wrought Iron Nails;* G. B. Manley, Canton, Norfolk county, Massachusetts, Dec. 14.

"Take good fibrous iron, and roll it the thickness of the nail required; the bar and the slab should pass through the rolls in the same manner as it is drawn, that the grain or fibre of the iron may be laid one way: then the sheets, or plates, are slit into strips, across the grain, of sufficient width for the length of the nail required; making proper allowance for drawing the edges."

The strips are then to be drawn by hand or strip hammers; and the heading is to be performed with dies, giving to them that shape which wrought nails require.

The claim is to the "drawing the edges of strips, either by hand hammers, or by tilt or trip hammers, or by rolling, which gives the nail the form and properties of the best wrought nails."

To us, who have frequently witnessed the rapidity with which the nailers form wrought nails from rods, it appears improbable that much advantage in point of expedition can be gained by the plan of the present patentee, as after the rolling, each nail must be handled three times, whilst by the ordinary mode once is sufficient.

---

15. For an improvement in the *mode of making Spoons;* Archibald Little, Bridgetown, Cumberland county, New Jersey, December 14.

The mode here patented is the employment of the common drop press, and steel dies. The lever or screw press, we are informed, will answer the purpose.

The claim is to "the mode of making spoons in dies, with the apparatus before described for that purpose, instead of the usual mode of hammering, or casting."

A patent for a similar purpose was granted on the 27th of December, to Robert Butcher of Philadelphia; but we believe this latter gentleman intends, principally, to raise spoons out of sheet tin. The specification of his patent will be found in the present number.

---

16. For a *Thrashing Machine;* George Jessup, Troy, Rensellaer county, New York, December 14.

The claims are

"The having the thrashing wheel or cylinder, revolve upon points or centres, as contra-distinguished from gudgeons."

"The manner in which the upper fluted roller is made moveable up and down, and in which the necessary degree of pressure of the roller upon the straw is effected."

"And in the horse machine,

"The manner in which the power and motion are communicated from the lever to the thrashing or other machine, to which the same are to be applied."

"The manner in which the motion may be accelerated."

"The manner in which the tension of the rope or band may be increased or lessened."

As these modes and manners do not bring to light any new principle, or combination, we need not describe them.

---

17. For a *Water Wheel* for propelling Machinery; James Johnson, Fairbanks, Sullivan county, Indiana, December 14.

We cannot take the trouble to revert to any of the patents which are identical in principle with the present, nor will the readers of this journal require it. Leaves, or buckets, are hinged to arms projecting from the solid hub on the end of a shaft. The buckets are to open and close, like shutters, by the action of the current.

"Your petitioner claims the whole wheel above described to be his invention, the shaft excepted."

The shaft, and even thew ater itself, might be as fairly claimed, as is this whole wheel.

---

18. For a *Machine for Propelling Machinery;* Thomas D. Newson, and James C. Shule, Nashville, Davison county, Tennessee, December 14.

The utter worthlessness of this machine will be at once perceived by every machinist, when we say that power is to be gained by means of a pendulum, which pendulum is to be kept in motion by a double rimmed cog wheel, each rim having cogs and intervals alternately; the alternate cogs are to take into a pinion, to keep the pendulum swinging. Those who believe in the possibility of perpetual motion have gone beyond us, and are above our instruction; those who do not, have no need for it on an occasion like the present.

---

19. For a *Circular Slide Rest,* to be used in the turning lathe, by which round balls, elliptical balls of any proportionate diameter, convex or concave surfaces, bowls, or segments of a circle may be turned; M. J. Gardner, York, York county, Pennsylvania, December 14.

The parts of this slide rest, are perfectly well delineated and described. The rest revolves upon a circular groove on a firm bed, and chisels of different kinds may be fixed in the upper part of it. The whole is considered as new, no part being claimed. Its application to circles and to segments of circles is apparent, but we do not perceive how it is to be advantageously applied to "elliptical balls."

---

20. For an improvement in the *Art of Sawing Timber;* David Stern, Venderburgh county, Indiana, December 14.

This saw mill is to be worked by horse, or other power. The carriage descends upon an inclined plane, and has to mount up hill by means of a tread wheel. The saw runs between fender posts in the usual way. The gearing consists of several wheels and pinions. The description and drawing are extremely imperfect; there is no claim, and nothing worth claiming, as neither in its principle or arrangement, does this machine offer any thing that is new or valuable.

---

21. For a *Machine for Cutting Paper;* John Shugert Quincey, Franklin county, Pennsylvania, December 14.

A cutting knife, very similar to that used for cutting dye woods, is fixed upon a bench. To insure its correct movements it works up and down between guides. To increase the power, the lever is made compound; that by which the handle of the knife is worked is attached to the bench by a joint; this lever is connected with the handle of the knife, by a jointed connecting rod. The paper to be cut is held upon the bench by a screw, and the sides of the ream are successively subjected to the action of the knife. The claim is to "the construction and arrangement of the above described machine for cutting paper, but particularly the compound lever and guides."

---

22. For an improvement in the *Art of Making and Curing Salted Beef,* and particularly of the description called jerked beef; William A. Tomlinson, city of New York, December 14.

(See specification.)

---

23. For an *Economical Oven;* Abel Stowell, Medford, Middlesex county, Massachusetts, December 14.

This is intended as an improvement on the common bake pan. A square box of iron is made, resembling the oven in a common cooking stove, and having a door on one side in the same manner. This box has a bail to it, by which it may be suspended, and has legs that it may stand on the hearth, with fire beneath it. Within the oven there is a moveable shelf dividing it into two parts. On its top there is a ledge, like that on the lid of a bake oven, to retain the fuel placed on it.

"What I claim as my invention, is an improvement on the common baking pan, by making the opening through which the articles to be baked or cooked may be placed within, or withdrawn from the said oven in a lateral situation, and which opening may be closed by a door connected to the oven, instead of the moveable cover as is usual; by which means baking or cooking may be effected in a more economical, cleanly, and expeditious manner, without subjecting the operator to the inconveniencies attending the employment of the baking pan in common use."

---

24. For a *Churn,* called a rocking churn; Nathaniel Tiffany,

and Ebenezer Robinson, Carolina, Tompkins county, New York, December 14.

A box is placed upon rockers, within this box slats are fixed, which serve as dashers, the cream passing between them as the churn is rocked. There is no claim.

---

25. For an improvement in *Trusses for Hernia or Rupture;* James Knight, Baltimore, Maryland, December 14.

We shall merely give the claim of the patentee to what he deems his improvement upon Hull's truss.

"What I claim as my invention and improvement, is a truss which is made to press equally around the body, by means of an additional spring and fixed concave pad, the pressure being graduated by means of a strap and buckle, by which the truss is permanently sustained around the body, making it different in principle from all other trusses. My truss can be worn sitting, lying, or standing, with so little inconvenience as to be worn by the youngest infant."

The additional spring is a short elastic strip of metal, by which the pad is attached to the principal spring.

---

26. For a *Compound Lever and Self-Weighing Scale;* Hosea H. Groover, Springwater, Livingston county, New York, December 17.

The specification of this patent describes seven different means of weighing by different apparatus, or by modifications of the same apparatus. The methods first described are on the principle of the steelyard, but are more complex, and we think less convenient than Dearborn's patent balance, an instrument which leaves but little to be desired in that way. The other means given are mere modifications of the bent lever, with an index to point out the weight.

The two kinds of apparatus, described and represented, appear to us to be so essentially different in their mode of action, as to require two separate patents. They are really different machines, although intended to attain the same end. The claim is to "the self weighing scale, and it compounded or blended with the steelyard or lever beam: and also the compounding the lever beam with the steelyard. The decimal graduations for weighing, and the appending cast iron notches and graduations to the wrought bar."

---

27. For a *Machine for Shelling Corn;* William Hoyt, Vernon, Jennings county, Indiana, December 17.

This machine bears a strong resemblance to the first machine for shelling corn, which was patented some five and twenty years ago. A wooden cylinder has iron spikes driven into it, and between this and an elastic casing the corn is operated upon. The legs are framed together in the form of an X, and this appears to be one of the improvements claimed.

"The improvement which I claim is the particular construction or application of the frame to the machine.—Its simplicity.—The manner in which the machine is thrown in and out of gear by the moveable bridge trees. And the manner in which it discharges the cob, while the shelled corn passes through the machine.

---

28. For an improvement in *Making Suspenders;* Allyn Baron, city of Philadelphia, December 17.

"The first improvement consists in substituting for brass or plated wire, which has been heretofore used for covering or wrapping the roller, pulley, or slide, spring, or cord, a substance commonly called sea grass."

"Second improvement consists in making use of a metallic ring, ferule, tube, plate, or piece; with holes to sew the same, and without holes, soldered and not soldered, to attach the said ring, ferule, tube, plate or piece, to the ends of roller, pulleys or slide, strings or cords for suspenders, whereby the said ends which have heretofore been knotted, burned, doubled, or whipped, are enlarged for the purpose of securing them to the loops, or button-hole pieces."

These may be great improvements, but the fraternity of suspender makers must judge of this. The law requires that there shall be "drawings, with written references, whenever the nature of the case admits of drawings." We are not aided by any thing of this kind, yet we think that a "metallic ferule, tube, plate or piece, with holes to sew the same," *admits of drawings.*

---

29. For making and constructing *Steam Engine Boilers;* John C. Douglass, city of New York, December 17.

(See specification.)

---

30. For a *Truss for the Cure of Reducible Inguinal Hernia;* Amos G. Hull, city of New York, December 20.

This is the fourth time a patent has been re-issued for this invention. It was first patented in July, 1817, surrendered and re-issued in February, 1823: again in August, 1824; again in October, 1829; and again as above.

These new patents all bear date with the first, and will expire on the 17th of July next. The object of surrendering and obtaining a new patent in the present instance is to use the amended specification in a litigated case. The lawyers certainly ought to know best, but we should be very apprehensive that a defective specification, which failed to explain clearly what was patented, would be likely to fail in sustaining what was intended, but omitted, to be described or claimed.

This truss is too well known to require description.

---

31. For an improvement in the *Truss,* which the patentee

denominates the "Elastic Truss;" Gershom Twitchell, Leominster, Worcester county, Massachusetts, December 20.

The bow, or belt, or retractor, which surrounds the body, is to be made of Caoutchouc, (India rubber.) If pieces of sufficient length cannot be obtained, they are to be joined together by a cement made by dissolving the India rubber in about five times its own quantity of spirits of turpentine. This cement is to have the consistence of candied honey; the ends of the pieces to be joined are to be made perfectly clean, then thinly covered with the cement, and put for some hours under a press. The straps are at first cut of double their intended width, as they are to be folded over and their edges joined by the cement used for joining the ends. The caoutchouc strap is to be covered with soft leather; metallic clasps are to be attached to it, and metallic plates, with a cushion of caoutchouc; a covering of leather, hinges, and suitable springs, complete the truss. There is no claim made.

---

32. For a *Washing Machine;* Ebenezer Lester, Killingworth, Middlesex county, Connecticut, December 20.

This washing machine differs in its structure and mode of operation from all those which we have hitherto described. It consists of a cylindrical vessel, the bottom of which is to be fluted on the inside, the flutes proceeding in radii from the centre; the sides are also to be fluted a few inches up. There is to be a dasher, consisting of a block of wood, with a shaft attached to it like that of a churn. The lower side of the dasher is to be fluted like the bottom of the vessel. The clothes are to be put into the vessel, with a sufficient quantity of water, and the dasher placed upon them; its shaft is to pass through a lid or cover. On the top of the dasher is a cross bar, or handle. "The machine may be operated by a person turning the dasher, horizontally, half, or quite, round and back. By this means a great saving of time and labour will be effected, without injury to the articles washed, as experiment has amply demonstrated."

"The inventor does not hereby claim as his invention, vessels, fluted work, or rollers, but merely the manner of improving them by uniting their operations in the mode above mentioned."

---

33. For a *Washing Machine;* Samuel Bushnell, Sen. Saybrook, Middlesex county, Connecticut, December 20.

We may transcribe without any variation, what was said in our last number, p. 167, respecting a similar machine. "A swing frame with a roller at the bottom of it, is made to vibrate by hand. The clothes are placed in a trough, with bed pieces of suitable curvature."

There is no claim, and as similar machines have been long since patented, tried, and condemned, we apprehend that the want of a claim will not be a source of loss.

To this we may add, that the drawing is without written references.

34. For a *Churn;* Samuel Bushnell, Sen. Saybrook, Middlesex county, Connecticut, December 20.

The shaft, or handle, of a common dasher churn is formed into a double rack, between the teeth of which a pinion is made to revolve by turning a crank. The teeth of the pinion are to take alternately into those of the racks, and the dasher is consequently to be made to rise and fall. A worse mode of accomplishing this purpose could not easily be devised.

There is no claim; no letters of reference to the drawing, and we may again add, but little likelihood of loss from these omissions.

35. For a *Revolving Grate for Grating Apples,* and other vegetable substances; David Flagg, Jr., city of New York, December 20.

The grating is to be effected in a well known mode, that is, by a cylinder furnished with teeth. The improvement made consists in the vertical end of the hopper, just above the cylinder, being formed of slabs, or bars of wood, retained in their places by spiral springs, which will allow them to give way, when stones, or other hard substances, are encountered by the cylinder. To these the claim is confined.

36. For an improvement in the *art of Boring Timber;* Frederick Beckwith, Saratoga, Saratoga county, New York, December 21.

A frame is made, having two uprights, or cheeks, like those of a standing press. Within this there is a sliding frame, passing freely up and down. A cylindrical vertical shaft fits and turns freely in holes at the top and bottom of the sliding frame; the augers, or bits, with which the boring is to be performed, are adapted to the lower end of the shaft. By means of a crank, or handle, motion is given to a vertical wheel, the cogs of which take into those of a horizontal wheel upon the shaft.

The machine is intended to be used in ship, bridge, and dock building, and for other purposes. We are not informed what part is claimed, and it resembles other machines for the same purpose so closely, that we should be at a loss in designating what is new in it.

37. For an improvement in the *mode of Propelling Spindles,* or machines for spinning wool; Russel Phelps, Andover, Essex county, Massachusetts, December 21.

(See specification.)

38. For a *Machine for Jointing and Gumming Old Saws;*

Henry Johnson Sidney, Delaware county, New York, December 23.

This is called an improvement on Newton's machine, for the same purpose. A lever, the fulcrum of which is near to one end, is used to force up a cutter with a triangular face, against a steel plate or bed. There is no difference in principle, but merely in arrangement, between this and the machine upon which it is called an improvement. The patentee, however, enumerates its good properties much at large. He tells us, for example, that "it need not be half the weight of Newton's." That "the principal plate need not exceed 13 inches in length," &c. The claims are to the particular manner in which this instrument is made. Among them is the "making the base, perpendicular, side guides to the driver, and supports to the fulcrum, all of one solid piece of iron," &c. &c.

In what the present patentee calls the original machine, we thought that there was but little originality, as may be seen by referring to our last volume, page 228. It must also be recollected that as this is confessedly an improvement upon Newton's machine, the consent of the original patentee is requisite to give a right to use the improvement.

---

39. For an improvement in *Making Wheels for Carriages;* Joel Eastman, and Guy C. Rix, Bath, Grafton county, New Hampshire, December 23.

The spokes of the wheel are not to be driven into mortises, but are of such a size at their inner ends, that when laid together in their proper positions, they come in contact with each other to a distance of several inches, and sustain each other; an axle passes through the centre of the wheel, and is secured there by an iron plate on the outside, and another on the inside, which cover the joinings of the spokes, and are firmly pressed against them by screws, or otherwise.

The axle, which is to be of iron, is to be "laid into a wooden axle tree, and secured in such a way as to turn freely, and yet be perfectly secure against coming off."

"The invention here claimed, is the mode of making carriage wheels as before described."

---

40. For a machine for *Cutting Screws, and Turning Iron and Steel;* Joel Eastman, and Charles Abbot, Bath, Grafton county, New Hampshire, December 23.

In this machine the cutting property of a disk of soft iron, or steel, when in rapid motion, is applied to the forming of threads upon screws of iron. The cutters are circular disks of from a foot to 4 or 5 feet in diameter, and of the thickness required. Their edges receive the form intended to be given to the thread of the screw, whether square, or angular. These wheels are fixed upon arbors, which are placed at such an angle with the piece to be cut, as the intended thread may require. A sliding frame of iron, with the necessary slides, guide screws, and other adjustments, receives the piece upon which the screw is to be cut, and causes it to advance as the operation is performed. The claim "is the application of the iron or steel wheel in cutting screws, screw bolts, and taps, and turning iron, steel," &c.

This, we believe, is the first machine to which the remarkable property possessed by soft iron in rapid motion, has been applied; excepting the occasional use of it as a cutter in the lathe. The machine is in actual operation, and we are assured, upon good authority, that it not only acts perfectly well, but performs the labour of cutting screws with a degree of rapidity, which leaves at a great distance, every other known mode of effecting this object.

---

41. For an improvement in *Percussion Gun Locks;* Michael Carleton, Haverhill, Grafton county, New Hampshire, December 23.

A straight bar of steel is contained within the stock, behind the breech pin. This, by sliding forward, is to operate as a hammer, to fire the powder. The guard operates as a spring to force this bar forward, the fore end of it passing through a small mortise, and entering a notch in the box, or hammer. When the hammer is drawn back, it is caught and held by the trigger. There is a very minute description of all the parts of the lock, but no claim made; we are not aware, therefore, of what is intended to be patented. Percussion guns have been made to resemble walking sticks, and a hammer used, the position of which was like that described: concealed locks of various kinds are also known to those conversant with this subject. We see nothing in the present plan which offers much either of novelty or utility.

---

42. For an improvement in *Machines for Separating Gold from Sand, Earth, &c.;* Frederick D. Sanno, Philadelphia county, Pennsylvania, December 24.

This patent is taken for two machines, to be used either alone or in succession. The apparatus the patentee calls the *American Gold Finder;* without the drawings the particular arrangement of the parts cannot be explained. The first machine is called a preparer; in this the particles of gold are to be separated from the stones, and the lighter portions of earth. The washing is effected in a cylindrical vessel placed like a bolter, allowing the heavier particles to pass through into a box below. This portion is to be further washed in the second machine, which is called a cleansing machine. In this it is subjected to the action of sieves, vibrating troughs, and other appurtenances. The claim is as follows.

"What I claim as my invention is the construction and arrangement of the before described machines for separating gold from earth, stones," &c.

This general kind of claim, when a machine consists of many parts not new in their structure, does not appear to us to fulfil the requirement of the patent law, which makes it necessary that the applicant for a patent for any machine should distinguish the same "from all other things before known."

---

43. For a method of *Manufacturing Spoons from Tin Plate,* Tin or Pewter in sheets, sheet Silver, or other metal; Robert Butcher, city of Philadelphia, December 27.

(See specification.)

---

44. For an improvement in the machine for *Trashing Wheat,* and other grain; Rufus Humpreys Victor, Ontario county, New York, December 27.

This machine is so precisely like a great many other thrashing machines, that we should not, unaided, have discovered any point of difference; the patentee, however, informs us that "it differs from all machinery of this kind now in use, in the simplicity of its machinery, and the cheapness of its construction, it being designed to be propelled by one horse." This one horse is to apply his power in the usual manner. In this thrashing machine, "the rows of teeth on the cylinder play between similar teeth, fixed in the same manner on a bed piece. The cylinder and bed piece are both covered with sheet iron, and the teeth are drove through this. Between this bed piece and the cylinder the straw to be thrashed passes. The machine is fed by an apron leading to the cylinder, in the common way." Thus endeth the specification; there being nothing in the form of a claim, unless the *simplicity,* and *cheapness,* are intended as such; but to us these are not only intangible, but invisible.

---

45. For an improvement in the mode of *Making Ivory, Bone, and Wood Combs;* Julius Pratt, Minden, New Haven county, Connecticut, December 28.

The back of the comb is to be made in a separate piece, and it is recommended to form it by turning. This piece is to be drilled to receive the teeth, which are also to be in separate pieces, and are to be formed by turning, or otherwise. Both the back and the teeth are to have the grain of the material running lengthwise.

"This improvement in the combs made in this manner, for which a patent is claimed, consists in having the back and teeth of the comb both running with the grain of the material of which they are made, whereby their strength and durability are greatly increased. This improvement is particularly useful in the making of ivory combs, as it greatly increases their strength and durability, and enables the operator to construct the teeth of the comb out of pieces, or chips of ivory, which are nearly useless for other purposes."

"I claim as my invention and improvement the comb of the above description, made of ivory, bone, or wood, with the grain running lengthwise with the teeth and back. I also claim as my invention and improvement, the mode of forming the back and teeth by turning them, as above described."

The present patentee, if he is "the true and original inventor," has been rather tardy in asserting his claims. On the 14th of April 1829, Nathaniel Bricknell of Connecticut obtained a patent, in which it is stated that "this improvement consists in forming the back of a comb in a separate piece, or separate pieces of wood, so fastened to the back of the comb blade as that the grain will run at right angles with the grain of the wood forming the comb blade and comb teeth."

On the 11th of June in the same year, a patent issued to John Brown, of Providence, Rhode Island, for making small toothed combs out of small scraps, by connecting such pieces to pieces of hard wood, horn, or any other suitable substance.

The interference of these claims is perfectly manifest, and either one or the other of these patents must be untenable.

---

46. For an improvement in the *Steam Engine*, and feeder of the boiler; Ogden Mallory, Oswego, Oswego county, New York, December 28.

The object in view will be seen by the following claim.

"What I claim as new, and as my own invention, or discovery, is the application or power of steam to a reciprocating, or semi-circular cylinder, or engine, or a semi-reciprocating rotary motion, or piston head, or wing, &c. And obtaining from such reciprecating or semi-rotary motion, or piston head, a full rotary motion; and thereby obtain the power of steam for propelling or driving machinery of all kinds," &c.

"And for feeding the boiler by a turning or revolving cock or cylinder, and keeping the water regular in the boiler, and at its proper point at all times," &c.

"And for regulating the force pump, or the supply of water for the boiler, by means of a valve or stop cock attached to the force pump, and adjusted by means of being connected to a weight in the boiler, which rises, or falls, with the water in the boiler."

Without possessing any of the advantages proposed by the rotary engine, the one here offered appears to us to unite all the objections to it; and we apprehend that it will be as difficult to obviate them as to make a "*semicircular cylinder.*"

A semi-cylinder is made, and closed at its ends, and across its diameter. Within this a wing is fitted, which is attached to a shaft, working on gudgeons in the centre of the circle, of which the semi-cylinder is a section. This wing must be packed so as to fit at its three edges, and the shaft to which it is attached, must also be packed to render it steam tight. The steam is to be admitted and discharged from each side of the wing alternately; and it is thus to be made to vibrate. A crank, or lever, firmly attached to one end of the shaft, gives motion to a fly wheel, by means of a shackle bar, or pitman. So much for this part of the invention.

The feeding is to be effected by means of a revolving, or vibrating cock or cylinder, which having cavities in it receives water from a supply vessel above, and carries it down, so as to deliver it within the boiler. This is one of the *Modern antiques*, which has been used both with, and without the sanction of a patent.

The third improvement is to be carried into effect by means of a float in the boiler, having a rod attached to it, which passes through a stuffing box. The upper end of this rod, is to be made to operate upon a cock, or valve, connected with the force pump, so as to regulate the quantity of water it shall supply. If floats, cocks, and force pumps, were not liable to get out of order, a contrivance of this sort might possibly be relied on; but as such is not the fact, this and the analogous appendages which have preceded it, are not likely to afford the desired security.

---

47. For an improvement in the mode of *making Cotton Roving;* Samuel P. Mason, Leesville, Middlesex county, Connecticut. Patent first issued June 24th, 1830. Cancelled and reissued, December 29.

The specification commences by saying, "the essential principle which I claim in the speeder for making cotton roving, and which distinguishes it from all other speeders now in use, consists in the peculiar structure of the spindle, and the application of the flyer to that spindle."

The objection of a want of claim, which we originally made, is here removed; but the remark respecting the impracticability of making the nature of this machinery known without the drawing, still applies. We do not, therefore, attempt a description of it.

---

48. For a *Machine for Tempering Clay and Moulding Bricks;* John C. Porter, Powhatan county, Virginia, December 29.

The clay is tempered by pairs of rollers running in troughs: there may be three, or more, such pairs placed below each other; the clay is placed above the upper rollers, and passes down through those below. A supply of water is admitted to the upper trough, in quantities sufficient for the intended purpose.

The moulding is effected in a circular trough. This trough is constructed much like those most commonly employed for tempering clay, and it has also a vertical shaft, and a roller running round in it, in a manner similar to those used for that purpose; but in the present instance the roller is employed to press the tempered clay into moulds. Single or double moulds are placed round in the trough, there being proper openings in the side of it to admit them. The tempered clay is placed within the trough, and the roller passing over it, presses it into the moulds. An iron scraper follows the roller, and removes the superfluous clay from the moulds. The bricks are then to be discharged, and the moulds replaced.

The claim is to "the machine, before described, for tempering clay, and moulding bricks; particularly the circular trough, the supports to the moulds, the cylindrical presser, and scraper."

If the claim to the whole machine is good, those to the particular parts are, at least, superfluous; if the claim is not good, it cannot be sustained by claiming the particular parts.

---

49. For a mode of *Causing Cloth to pass, and be stretched while passing, over a Revolving Cylinder* prepared with points, or teazles, for teazing, or raising, the pile or nap upon cloth; John Jewell, Dudley, Worcester county, Massachusetts, December 30.

The specification of this patent is written with unusual precision and clearness, and the machinery described is well represented. All we can give is a general idea of the plan pursued, so far as it can be understood by a quotation from the beginning, and another from the end of the specification. The whole description would occupy several pages of the Journal.

"The cloth to be teazed, is to be wound upon a revolving cloth beam, and from that made to pass over and under rollers, and over the revolving cylinder prepared for teazing it; and over and under rollers on another revolving cloth beam, on which it is to be wound up as it comes from the first beam, after having passed over and under the rollers and cylinder aforesaid; and then, by a change of motion, after it has been unwound from the first beam, it may be made to pass back over and under the rollers and cylinder aforesaid, and be again wound upon the first beam, as it comes off from the beam upon which it was last wound up, the motion of the cloth beam and rollers being given, regulated, and changed, in the manner hereinafter described and explained, which description may be best understood by reference to the plan hereunto annexed."

Conclusion.—"It is to be understood that although I have in my plans, and the explanation thereof, mentioned a cylinder prepared with points or teazles, for teazing cloth, yet, I do not claim as a part of my invention, such a cylinder, either separately, or in combination, nor the raising of naps on cloth by means thereof; and although I have mentioned stretching rollers, which ought to be the stretching rollers now used for stretching the cloth widthwise, yet I do not claim the same, either separately or in combination, as a part of my invention, nor the stretching of cloth widthwise. And, as to the rest of the machinery described, none of it is claimed separately, and only so much of it in combination as is adapted to give motion to, and regulate and change the motion of, the feeding rollers, so as to regulate and change alternately the motion of the cloth, and draw it tight and smooth over the cylinder prepared for raising the nap upon it."

Specifications of American Patents.

Specification of a patent for an improvement in the art of heating or warming rooms, dwelling houses, offices, hot houses, churches, or any other public or private building, of any description or size, by means of a machine, apparatus, or implement, which he denominates a "Portable Steam and Hot Water Stove." Granted to Thomas Green Fessenden, *Attorney at Law, Charlestown, Middlesex county, Massachusetts, December* 14, 1830.

My improvement consists in a portable steam and hot water stove, which may be constructed as follows, viz. the case, or outside, may be made of cast iron, sheet iron, wrought iron, or any materials which will withstand fire; including all those which are or may be used for fabricating stoves or fire places. This case may be a hollow cylinder, or of an elliptical shape, a square, a parallelogram, or any other shape which taste, convenience, or fancy may dictate. Its dimensions should be of a size proportioned to the size of the room which it is wished to warm. A cylinder, 24 inches in length and 12 inches in diameter, fitted with boilers and tubes, as hereafter mentioned, has been found by experiment sufficient to heat about 3000 cubic feet of space in a room finished in the common style, and as well adapted as usual for the exclusion of external air. The case of the stove may be placed in a perpendicular position, elevated on legs or otherwise, so as to stand about two inches above the hearth or floor of the apartment. The lower end of the cylinder being closed with a plate of iron, or other suitable substance, serving for the bottom of the ash pit, which may occupy about 6 inches of the lower end of the cylinder. This plate may also extend several inches in front of the stove, and its exterior extremity being properly supported by legs or otherwise, answer the same purpose as a hearth for a fire place, and a footstool, or stand, on which the feet may be placed for warming. An aperture closed by a door near the bottom of the cylinder is used for taking away the ashes. This door may be fitted with a register to admit more or less air, as in common stoves.

Immediately above the ash pit, within the cylinder, is placed one or more boilers. The first, or lower boiler, is hollow sided, and consists of two concentric tubes of equal lengths, but of different diameters; the length about five inches, and the diameter of the outside tube just equal to the interior diameter of the case; so that the sides of the case and the boiler may sit close, and no air admitted between them can make its way over the fire place and carry off the heat. The tube which constitutes the inner part of the boiler, is about two inches less in diameter than the outside tube, which forms the exterior part of the boiler. Circular end pieces are soldered between the tubes at both ends; the upper end piece being perforated with several holes to admit two, or more tubes, leading to a second boiler; and, likewise, there is an advantage in having two, or more tubes, leading to the first steam receiver, as well as two, or more tubes, of about an inch in diameter, placed on the same level, and crossing the interior of the boiler, near its bottom.

Within the hollow sided boiler, is placed a grate, on which is a hollow, cylindrical vessel of cast iron, or other suitable metal, or substance, for a fire pot. These should be so shaped and placed, as not to touch any part of the boiler, or tubes, before mentioned, lest, when heated to a red heat, they should burn out, or unsolder the tin with which they come in contact. Within the cylinder, or case, and about six inches above the top of the first boiler, is placed a second boiler, set perpendicularly over the fire bed. The second boiler communicates with the first boiler by two, or more, tubes, placed at opposite sides, of about an inch diameter; and if there are enough of them to extend quite round the periphery of the boilers when placed an inch apart, except at the doorway, where the fuel is introduced, there will be an advantage arising from their exposing a large surface of metal and water to the action of the heat. The second boiler need only be about an inch think on the inside, and its circumference, or horizontal diameter, should be such as to leave a space of about an inch between the sides of the case of the stove, and the sides of the boiler. Between the hollow sided boiler and the boiler last described, an aperture is cut in the front part of the case, to which a door is adapted for introducing the fuel. This aperture may extend nearly half round the stove, its bottom being about on a level with the top of the lower boiler; and the top of the door way should be about two inches beneath the bottom of the second boiler. When the stove is in use, the door may be kept open, and thus give at once a sight of the fire and the advantage of its radient heat. Between the second boiler and the top of the cylinder, and as near the top as is practicable, the smoke is delivered by a pipe leading into a chimney, or other avenue for its escape, as in common stoves. The top of the case, or cylinder, may be closed by a lid of sheet iron, through which a tube, or several tubes, leading from the top of the second boiler, into the first steam receiver, ascend. Or the first steam receiver may rest upon and close the top of the cylinder. It will be well to have three, four, or more tubes, of about an inch in diameter, leading from the top of the second boiler into the lower steam receiver. These tubes may be placed at equal distances, near the periphery of the second boiler, and lead in a perpendicular direction into the first steam receiver. Or a single tube, of from two to four inches in diameter, may lead from the centre of the second boiler to the centre of the first steam receiver. A short tube, of about one inch in diameter, enters the lower boiler about an inch from the bottom; projects, horizontally, through the case about three inches, and is fitted with a cock for drawing off the water when it is wished to empty the boiler. A similar, but smaller tube, enters the steam receiver just above the fire line of the stove, and near the bottom of said receiver, for the purpose of ascertaining when there is water in the stove in sufficient quantity for putting it in operation, without danger of unsoldering the tin, and for drawing off that water which is not necessary to prevent the tin work from being burned or unsoldered.

The steam receivers consist of several vessels of tin, or other suitable substance, (not copper, for the effluvia of that metal when heated is unwholesome,) placed perpendicularly over the boilers before described, with which, and also with each other, they communicate by steam tubes. The number and dimensions of the steam receivers should be proportioned to the size of the fire pot, boilers, and the cubic space which it is intended to warm. From actual experiment, I am induced to believe, that a cylinder, fire pot and boilers, fitted as above, would require about fifteen superficial feet of steam receivers to condense the steam generated in a cylinder, twelve inches in diameter and two feet in length, fitted with boilers and tubes as mentioned above; and this apparatus will be sufficient to warm about 3000 cubic feet of space, as stated above. The steam receivers may be of any shape which convenience, or fancy, may dictate, but it will be expedient to have them so placed and shaped that they may present a large surface in proportion to their capacity. The form which I have adopted, and which may perhaps be as eligible as any, is that of flat, circular vessels, each about ½ inch thick, or perpendicular depth, and placed about three inches perpendicular height, one above the other, with a gradual decrease of horizontal diameter from the lowest upwards. For instance, suppose the lowest steam receiver to be about 15 inches horizontal diameter, and to rest on the top of the cylinder, or case, of the stove. The next steam receiver may be 14 inches horizontal diameter, placed three inches above the first, with which it communicates by three or more tubes, of about 1½ inch diameter, placed about equi-distant, near the outside of the receivers. The next steam receiver may be placed 3 inches higher, and be 13 inches horizontal diameter, and so on until they are six in the whole, and the upper one is ten inches in horizontal diameter. These flat, circular vessels, are surmounted by a vessel resembling the frustrum of a hollow cone, placed three inches above the upper steam receiver, with which it communicates by a tube or tubes. This vessel may be large enough to hold about three quarts, and into this, water is poured to fill the boilers. It has a lid, or cover, similar to that of a common tea kettle, which is made to sit somewhat loosely in its place, so as to admit air by its sides, and thus prevent the steam receivers from collapsing by the pressure of the atmosphere when the steam condenses, and to admit a portion of the steam to escape when there is more generated than can be condensed by the steam receivers. A damper should be fitted to the smoke pipe, as in common stoves.

Although I have adopted the above mentioned form of construction in the steam stove, yet this may be varied indefinitely; and as the statute declares, that simply changing the form and proportions of any machine shall not be deemed a discovery, I shall hold the unlicensed adoption of the principles of my stove, under any possible form or modification, to be a violation of my patent right.

The novelty of the invention consists in an easily portable apparatus, which presents a convenient mode of arresting the heat produced from combustion on its passage from the interior of the stove to the chimney, by exposing as large surfaces of water as is conveniently practicable to the action of the caloric, and distributing the latent heat of the steam thus created, where it is most wanted; and condensing and bringing it back to the boilers without the apparatus of valves, syphons, &c. heretofore thought necessary in heating apartments by steam.

Observations by the Patentee.

THE heat which is generated by the combustion of fuel, is either *combined* or *radiant.* Combined caloric is united with the smoke vapour and heated air which rise from the burning fuel; and in common stoves and fire places, nearly the whole of the combined caloric escapes by the smoke-pipe, or chimney, and is lost. Count Rumford asserted that the quantity of combined heat which thus escapes, is much more considerable, perhaps three times greater at least, than that which is sent off in rays. And yet, small as is the quantity of this radiant heat, it is the only part of the heat generated by the combustion of fuel burnt in an open fire place which is ever employed, or which can ever be employed, in heating a room. The metal and water contained in the apparatus above described, intercept and form reservoirs for this combined heat; a part of it is detained, and distributed from the lower part of the apparatus, and a part entering the steam receivers, presents extensive heated surfaces to the air of the room, by which it is speedily and effectually warmed. Water possesses the greatest capacity for heat of any known substance, whether it be compared with equal bulks, or weights. A gallon of water, heated to 212 degrees, contains at least 500 times as much heat as a gallon of air at the same temperature. Hence, a bottle of hot air for warming the feet, &c. would not be more than one five-hundredth part so efficacious as a bottle of hot water, of the same bulk and temperature. Besides, air, when heated, becomes specifically lighter than the air in its neighbourhood; of course has a tendency to ascend and carry its caloric with it to a higher position, where its heat is diffused without answering any good purpose in economy. And in common stoves, the air of the room which is warmed is vitiated by coming in contact with a surface of hot iron, often heated red hot, by which its mass is rendered less fit for respiration, and head ache and languor are induced. But in my steam and hot water stove no part of the apparatus is heated much, if any, above the temperature of boiling water, the small particles of dust which float in the air not being burnt, it remains fresh and uncontaminated.

That an apparatus for heating rooms by hot water and steam, which is portable, and requires but little care or skill in its attendance, is *new*, as well as useful, may be made evident from the following passages quoted from the British writers who have published works on warming and ventilating rooms, &c.

In a work entitled "Practical and Descriptive Essays on the Economy of Fuel and the Management of Heat," by Robert Buchanan, p. 240, it is stated that "although in situations in which there is a steam-engine, or a regular supply of steam kept up for other purposes, it may be proper to use steam for warming buildings, yet, when that is not the case, unless a person can be appropriated to the sole purpose of attending on the boiler, I should hesitate to recommend it." It is likewise observed in Tredgold's "Treatise on Warming and Ventilating Rooms," &c. p. 19, "Wherever steam is employed, it should be under the direction of a person competent and willing to attend to it. For though, in such hands, it is perfectly safe and easily managed, it is by far too complicated to be trusted in the hands of careless and ignorant people." It is also observed in a treatise entitled "The Theory and Practice of Warming and Ventilating Public Buildings, Dwelling Houses, &c. by an Engineer," published in London, in 1825, that "it will seldom be found adviseable to use steam in warming dwelling houses, unless the establishment of servants is very numerous." My steam stove requires less attention than a common fire place. A small quantity of water (eight or ten quarts,) will answer for a whole winter, as the steam is condensed and brought back into the boiler. The apparatus is perfectly free from any danger of bursting or exploding, as the steam is not confined, nor its passage obstructed until it reaches the upper steam receiver, which is closed only by a lid, sitting as loosely as that of a common saucepan.

Among the advantages which a portable steam stove possesses over a common stove, may be numbered its security from communicating fire to the apartment in which it is placed, as the fire place is surrounded and surmounted by water. Moreover, the steam receivers furnish a series of shelves, standing one above another, on which plates, dishes of meat, &c. may be kept hot; or linen, vegetables, &c. &c. may be dried.

Thomas G. Fessenden.

A, A, A, A, the cylinder enclosing the fire place. B, B, the first side boiler. C, fire pot. D, D, tubes leading from the side boiler to the steam receiver. E, second boiler. F, F, tubes leading from the second boiler to the first steam receiver. G, G, G, steam receivers. I, I, tubes leading from one receiver to another. K, K, cocks for drawing off the water. L, smoke pipe leading into a chimney.

Fig. 1. Perspective view of the stove.

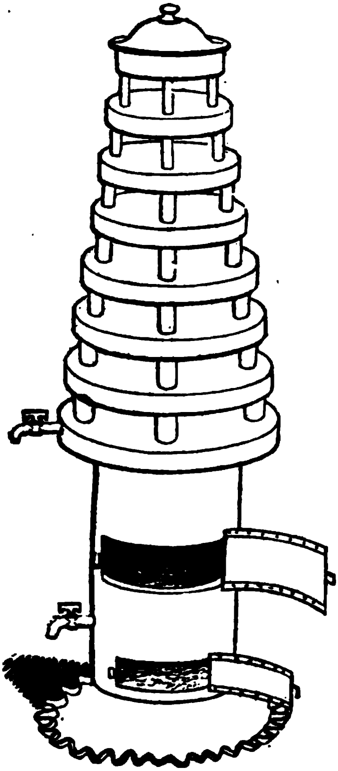
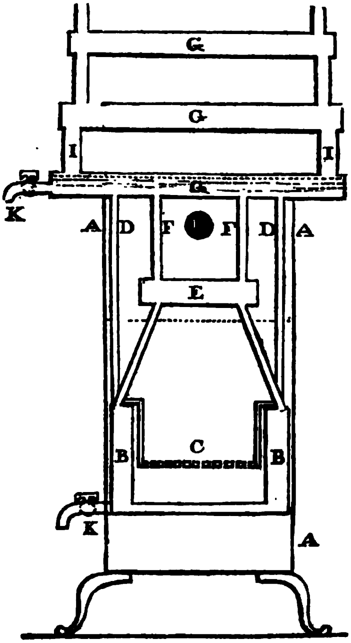


Fig. 2. Section.



Remarks by the Editor.—We have no doubt that the stove described in the foregoing specification, is a very good one, as regards the economy of heat, and the equable manner of its diffusion. Still a large portion of the heat extricated in the combustion of the fuel is liable to escape from this, as well as from most other stoves. The smoke pipe, L, leading into a chimney, must carry off both heated air and vapour, the *uncombined* heat of which must consequently be lost. If it is supposed that a stove of this description will absolutely give out more heat than one of the ordinary construction, this supposition is erroneous. The heat in a stove, or other fire place, is all extricated in the combustion of the fuel, and if, in a stove, the pipe is of sufficient length, and exposes a sufficient surface to the action of the atmosphere, to allow the heated air to become cooled nearly to the temperature of the room before it escapes into the chimney, all that the fire is capable of communicating is obtained. The use of steam in the way proposed, will not in the slightest degree increase this quantity, although it may diffuse it more equally than a stove ordinarily does.

We do not think that the "Observations by the Patentee," proceed, in the first instance, upon principles which are correct. "Combined caloric," he tells us, "is united with the smoke, vapour, and heated air, which rise from the burning fuel; and in common stoves nearly the whole of the combined caloric escapes by the smoke pipe, or chimney, and is lost," and we are left to infer that such is not the case with the stove in question. The watery vapour which arises from burning fuel may be condensed, and made to give out its combined caloric, and if the pipe be of sufficient length, as before remarked, the *uncombined* or free caloric of the *heated air*, may also be liberated; but such is not the case with its combined caloric. The combined caloric of smoke, spoken of by the patentee, is a species, or modification, of caloric, with which we are unacquainted.

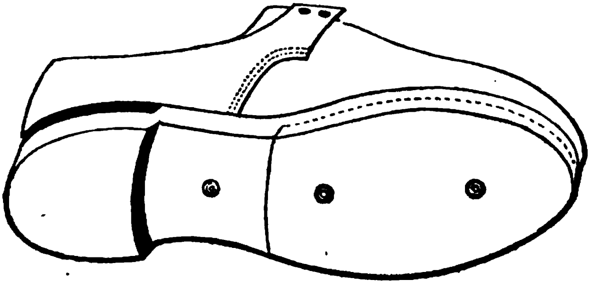
We think that the patentee has not chosen the proper place for his observations on the theoretical action, and the utility of his invention. These are matters which certainly do not belong to a specification. To us they appear as much out of place, as a disquisition upon the fertility of the soil, and the value of its products, would be in a deed of conveyance for a farm. In both cases, the metes and bounds are the proper subjects of description, in order that we may not lap over on our neighbour's property.

If such a disquisition is in place in a specification, there is nothing to prevent a patentee from writing a treatise upon the subject to which his patent relates, and sending it to the patent office to be engrossed upon parchment.

Specification of a Patent for an improvement in the mode of making or manufacturing Shoes and Boots, called the Farmer's double improved Boot and Shoe Sole. Granted to Moses Pennock, *East Marlborough, Chester county, Pennsylvania, December* 14, 1830.

The first lift of the heel of the boot or shoe, constructed at first in every other respect in the ordinary manner, is made to extend to that part of the shoe or boot which corresponds with the interior part of the hollow of the foot: that is to say, about two and a half inches beyond the heel forward towards the toe. To the top piece of the heel, as they are usually formed, an additional piece is then appended by as few nails or pegs as will serve to hold it firmly to its place. There is then fitted to the outer surface of that part of the sole which intervenes between the interior part of the extended lift of heel and the toe, a wearing sole, composed of a single thickness of sole leather, which is attached to the first mentioned sole by means of a sufficient number of nails, or pegs, driven at the distance of three-fourths of an inch, or an inch, apart, along its margin. Care should be taken in driving the pegs or nails, that they may escape the seams in the sole above.

Pennock's Farmer's Double Shoe.



Manner of Using.

When the outer sole and heel piece of a shoe or boot constructed in this manner are worn through, they may be replaced by others at a very small expense, and the superior heel piece and sole remain in as good wearing order as at first. The superior sole not being injured in its unexposed situation, may be used to great advantage as a wearing sole for new uppers after the first are worn out; and it is found by the experience of the inventor, to endure much longer than new and unseasoned leather. The outer sole and heel piece may be renewed at pleasure, as long as the uppers continue in good wearing condition.

MOSES PENNOCK.

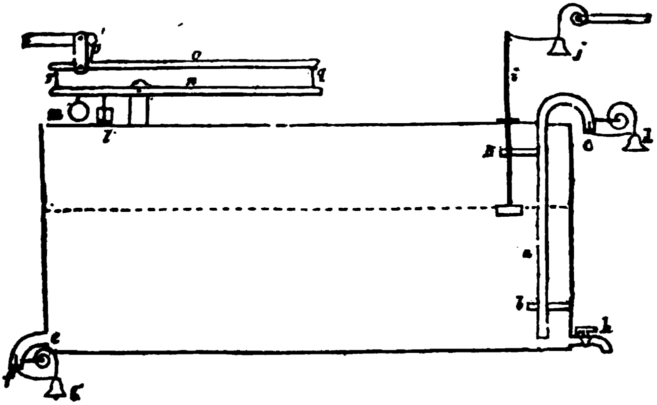
Specification of a patent for an improvement in the art of Making and Curing Salted Beef, and particularly of the description called Jerked Beef. Granted to WILLIAM A. TOMLINSON, *city of New York, December 14th,* 1830.

A ROOM, or building, of any description, intended to be used for the purpose, is to be warmed, or heated, by an open fire, or fires, or by a close stove, or stoves, or furnace, of any material or description, and the warm air allowed to circulate freely through it; and the beef being previously salted, or pickled, and cut in such form as best to receive benefit in drying, is to be placed in the room, or building, as above described, either by being suspended, or placed upon racks, or netting, or otherwise disposed, so as best to obtain benefit of the warm or heated air, and is thus to remain; its position to be changed if necessary, until it becomes sufficiently dried to keep; and may then be transported loose, or packed in boxes, or other packages, to any place for use: it is also a part of the process, when preferred, to furnish the room, or building, with windows, so as to admit the rays of the sun to aid the artificial heat or warmth in the drying process; or the beef may be alternately exposed to the artificial heat and the rays of the sun, by removal from the room, or building, to the external, or open air, and returned again; and also *vice versa.*

The benefit to be obtained by the above process and its parts, in the making and curing salted beef, and particularly the advantage in the making and curing of jerked beef, over the mode hitherto practised for that article, (that mode consisting in drying the beef by exposure in the open air to the sun alone,) consist in drying the beef more uniformly and equally, giving it a better and sweeter flavour, and enabling it to be kept longer in any climate without spoiling; and is also a great saving in the expense and time of curing, as the drying goes on during any weather. The application of artificial heat, without the aid of smoke to the curing and preserving of salted beef, and particularly that description of salted beef usually called jerked beef, is a new invention and discovery, and is deemed an application of an *old* principle to a *new* purpose, of such importance as to be entitled to a patent. Wm. A. Tomlinson.

Specification of a patent for improvements in the making and constructing of Steam Engine Boilers. Granted to John C. Douglas, *city of New York, December* 17*th*, 1830.

J. C. Douglas' Steam Engine Boiler.



What I claim as my specific improvements, consist, first, in having a pipe (*a*) of five inches diameter, near the furthermost end of the boilers, to go from the top to within two inches of the bottom, near which it is fastened by an iron stay (*b.*) The top of the pipe terminates with a vacuum valve, (*c*) having a bell (*d*) connected to it by a wire, for the purpose of notifying the Captain, or Pilot, of its motion.

Secondly. To insert in the front end of the boiler, at the height of two inches from the bottom thereof, another pipe of five inches diameter, (*e*) terminating with a vacuum valve, (*f*) having a bell (*g*) annexed, (as with the first mentioned pipe,) to notify the engineer of its movement.

Thirdly. To have a water cock (*h*) in the front end of the boiler, at the height of two inches from the bottom thereof.

Should the engineer, on being notified by the ringing of the bell, (*g*) turn the cock, (*h*) he will find no water at the bottom of the boiler.

He must then damp the fire, open the safety valve, and, as soon as he finds water runs from the cock, (*h*) he may commence pumping into the boiler. (But if the cold water had been pumped into the boiler before the above preliminary steps were taken, it would cause the metal to have shrunk, and a rupture must have been the consequence.)

Fourthly. A floating water gauge, perforating the top of the boiler and indicating the number of inches of water therein, is formed of a hollow ball, with sufficient weight, just barely to immerse the ball in the water; attached to it is a polished piston rod, (*i*) which works through the stay, (*k*) and the *stuffed* box on the top of the boiler. A bell (*j*) connected with the piston rod by a chain, will give notice when the water has fallen to the level of the lowest water gauge.

In many instances the water-gauge-cocks, as they are now used, serve only to deceive the engineer; who, finding water to issue upon turning one of these cocks, naturally concludes that the water in the boiler is up to the height of that cock, while, in reality, it is several inches below it, (the water which issued from the cock being only the steam which had condensed in the tube.) The great pressure of the steam prevents the admission of the requisite supply of water, although the forcing pumps have put it in motion, and hence another cause of error.

Fifthly. A safety valve (*l*) having the weight (*m*) which the boiler is calculated to bear, suspended on its beam as usual, but the latter is extended beyond its fulcrum, (so as to form a lever of the first order,) and at the extremity of the longer arm (*n*) a chain (*g*) connects it with the end of the steelyard, (*o*) whose fulcrum (*p*) is raised a convenient distance above that of the safety valve beam. The shorter arm of the steelyard is then connected with the end of the beam on which the weight hangs, by means of the chain (*r*.) Now, whenever the steam begins to move the safety valve, it moves the other end of the beam down, which brings down also the corresponding end of the steelyard, and consequently, raises the other end with the safety valve beam on which the weight is hung, and the valve, being thus freed from the pressure of the weight, easily yields to the steam and lets it escape.

The steelyard can be so made that one pound of the pressure of steam can raise any weight necessary for the relief of the boiler.

In this last item, it is not the valve, but the appendages annexed thereto, as above set forth, that are claimed as the improvement; and which will render any boiler completely proof against any explosion, unless a greater weight on the safety valve beam is placed in the first instance, than the boiler is meant to bear. John C. Douglas.

Remarks by the patentee; prefixed to his specification.

I HAVE observed through the medium of the public prints, that the greatest number of the disasters which have happened to the boilers of our steam boats, have occurred after the water has been heated to that degree which has turned it into expansive steam.

If the valve is now open to allow the steam to escape, because the boat is not quite ready to go, or if the boat is stopped for any other purpose, the steam is generally let off when there is a pressure of twelve pounds, or upwards, on the beam of the safety valve; throwing open the valve thus suddenly gives the whole contents of the boiler a volatility somewhat resembling that of a well corked bottle of soda water when the cork is withdrawn, and the whole would be discharged in a second or two, were the aperture sufficiently large.

The moment the valve is opened, the whole fluid flies from the bottom of the boiler, and the great heat which is under the bottom makes it red hot in a few seconds, and generates a highly rarified air, which forms a vacuum under the steam.

Again, the valve is shut to give the steam power to operate on the engine, and the steam being now confined with the rarified air, a contest now takes place between them for the sole possession of the boiler; in a few minutes an awful explosion must take place, too often attended with death as well as destruction.

The engineer, just before the disaster took place, may have tried his gauge cocks and have found them all full of water, which must have been the case; for the rarified air had driven the whole contents to the surface of the boiler, but not one single drop remained at the bottom; the vacuum valve on the top of the boiler is of no manner of use when the above described disaster takes place, for the whole surface is occupied by the pressure of the steam which keeps the valve shut.

The only time this valve is of service, is, when the boiler is receiving a supply of water, which, by condensing the steam, forms a vacuum, which is filled through this means by the exterior atmosphere.

JOHN C. DOUGLAS.

Remarks by the Editor.—We are unable to follow the patentee of the above described boiler, either in his theory or practice. We certainly accord with him in the first of his remarks, that an explosion rarely takes place in a boiler until "after the water has been heated to that degree which has turned into expansive steam." And if he is equally correct in all his assumptions, he is certainly the author of some notable discoveries; some in fact which must go far to revolutionize all the long cherished notions of philosophers on the subject of heat, air, and steam. It is a new discovery, that the rarified air at the bottom of a boiler will drive every drop of water to the upper part of it, and allow the bottom to become red hot. And unfortunately, the vacuum valve at the top, with its bell, will, in this case, be of no manner of use. It is a new discovery that the whole contents of a boiler would fly off in a second or two, on opening the safety valve, were the opening sufficiently large. The terrible contest between steam and rarified air, to determine the question which shall have the sole possession of the apartment, is an event of which we had never before been informed. But we cannot pretend to notice all these important novelties, and the consequences to which they inevitably lead, as we have neither time nor space for the investigation.

Specification of a patent for an improvement in the mode of propelling spindles or machines for spinning wool. Granted to RUSSEL PHELPS, *Andover, Essex county, Massachusetts, December* 21, 1830.

IN all the machines now used for spinning wool, which are called jacks, or billies, or jennies, the mode of propelling the spindles is by applying the power to one end, or the middle, of a cylinder, from which the spindles are successively banded.

My improvement consists in applying the power to both ends of the cylinder at once; and in order to produce this effect, I make a shaft of sufficient strength and length, to extend the whole length of the spinning frame, and attached thereto, on the back part of the frame; on each end of which shaft I secure a pulley, or wheel; to this wheel or pulley, I attach a band or belt, which, after passing over fixed pullies, in front of the machine, is strained over corresponding pullies, on each end of the cylinder which drives the spindles. This principal shaft is driven from the centre, or from any other point in its extension; and the effect of communicating motion from both ends of the shaft, to both ends of the cylinder, is to give a perfectly steady motion to the carriage, to which the cylinder is attached, and of necessity to the spindles connected therewith, and thus to produce better work; it also comes in aid of the squaring bands, in maintaining uniform motion. The great advantage derived from applying the moving power to both ends of the spinning frame, is, that by rendering the operation of the machine more easy and uniform, the number of the spindles may be multiplied to suit the convenience of the opeartor. In the jacks and billies commonly used in this country, one hundred and twenty spindles are the usual number attached to each frame; by the introduction of my improvement, double the number can be driven with equal ease, and without any additional skill on the part of the operator. RUSSEL PHELPS.

Specification of a patent for a new mode of manufacturing Spoons from tin plates, tin or pewter in sheets, sheet silver, or other metal. Granted to ROBERT BUTCHER, *of the city of Philadelphia, December* 27, 1830.

To all whom it may concern, be it known, that I, Robert Butcher, have invented a new mode of manufacturing spoons from tin plates, tin or pewter in sheets, sheet silver, or other metal, by means of cutting and stamping presses, and that the following is a full and exact description of my said invention.

When I manufacture spoons of sheet tin, I usually employ that which is known as three or four cross. This I planish, or hammer, with a polished steel hammer, upon a polished steel anvil. This not only polishes the surface, but condenses the metal, and thereby renders it the more durable.

When I use rolled sheets of block tin, pewter, silver, or other metal, or mixture of metals, I generally polish such sheets on both sides before proceeding to make the same into spoons; this, however, is not essential to the process.

In order to make the above named, or other metallic plates into spoons, I first cut the metal into the exact form required, by means of a steel bed, and cutter, in the way well known to the workers in metal. Any of the screw, lever, or drop presses usually applied to such purposes may be employed.

The blank or flat pieces for spoons being thus prepared, they are raised by means of a drop, or fly press, or by any other adequate application of power. A die, with a metal forcer, being employed for this purpose.

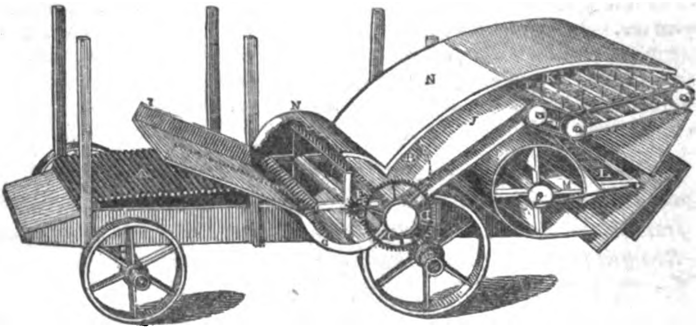
I do not claim to have invented any part of the machinery applied to this manufacture; but what I claim as new, is the manufacturing of spoons, without either casting or forging, by cutting and raising them out of sheet metal, in the way herein described; the same being a new manufacture.

Robert Butcher.

Specification of a patent for a machine for Thrashing and Cleaning Wheat and other grain. Granted to Samuel Lane, *Hallowell, Kennebeck county, Maine, April* 6, 1831.

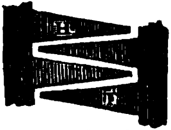
Lane's Thrashing and Winnowing Machine.

Fig. 1.



To all whom it may concern, be it known, that I, Samuel Lane, have invented certain improvements on the machine for thrashing

Fig. 2.



and cleaning wheat and other grain, which I denominate the portable horse power thrashing and cleaning machine, and that the following is a full and exact description of the said machine with my improvements thereon.

The power which I employ to drive my thrashing machine is the endless chain, and railway horse power, patented by me on the 17th of May, 1830. The mode of doing this, and likewise the general structure of the machine, is represented in the accompanying drawings.

A, Fig. 1, represents the inclined plane upon which the horse walks. B, a cog wheel on the end of the larger drum, over which the endless chain passes. This wheel may be 21 inches in diameter, and the pinion, C,* which it drives, 6 inches in diameter. The wheel, D, may also be 21 inches, and the pinion, E, on the shaft of the beaters, 6 inches; these relative proportions affording a sufficient velocity to the beaters.

The beaters have teeth, which may be made either of wrought or cast iron; they are to have, on their faces, the wedge-like, pointed, form seen at F, Fig. 2.

The hollow segment, G, is best made of cast iron. It is furnished with teeth of the same form and length with those on the beaters. The manner in which the teeth on the beaters pass those on the segment is shown at H, F, Fig. 2, where they are drawn of one-fourth of their usual size, and of the requisite space between them to allow the straw and grain to pass. The teeth I usually make upwards of two inches in length, as when shorter than this, the same quantity cannot be thrashed, there not being sufficient space. The pointed, or wedge-like, form of the teeth, their greater length than in other thrashing machines, and the space allowed between them for the straw, are essential features of my machine, and distinguish it from others which have been made to thrash by means of teeth.

The inclined board, I, is for the purpose of feeding. The straw and grain, after the thrashing is completed, are received upon an endless apron, J, passing over rollers. On this they are carried up to the endless sieve and rake, K. This sieve and rake are thus made—slats of wood, the length of the rollers, are attached to leathern straps, or bands, passing round the end of the rollers. These slats may be two or three inches apart, and they have wires projecting from their edges, forming a sieve. From the faces of the slats spikes project which form the rake to lay hold of the straw. The grain and chaff falls through upon a screen, L. To this screen a vibratory motion is given, from a crank on the shaft of the fan wheel, M, or in any other convenient way. The endless sieve, and the fan wheel, are driven by bands and whirls from the main machine. N, N, is a covering extending over the whole machinery.

It is manifest that this thrashing machine may be driven by other means than my patented horse power; I, however, deem this the most convenient.

---

* B and C are a wheel and pinion on the opposite end of the machine.

What I claim as my improvements are the particular form and arrangement of the teeth as described and represented; the receiving the grain and straw upon an endless apron, and thus carrying it up on the endless sieve and rake; the particular construction of the sieve and rake, and the general arrangement of the machinery by which these objects are effected.

SAMUEL LANE.

We have caused to be translated for the Journal the various ordinances, issued since 1823, of the French government in relation to high pressure steam engines. The ordinances are accompanied by circulars, explanatory of their details, and which emanate from different boards composed of officers of the corps of mines, and of government civil engineers, selected with reference to their peculiar qualifications for the task imposed. [COM. PUB.

Royal Ordinance of France, in relation to High Pressure Steam Engines, followed by instructions, and a Circular, on the same subject. 1823.

[TRANSLATED FOR THIS JOURNAL.]

Ordinance relating to High Pressure Steam Engines.

ART. 1. High pressure steam engines, those in which the elastic force of the steam exceeds two atmospheres, whether they consume their own smoke or not, cannot be set up except by virtue of authority obtained in conformity with the decree of 15th October, 1810, for establishments of the second class.

They will, besides, be subject to the following conditions, imposed in order to insure safety.

Art. 2. When authority for setting up such an engine is requested, the individual requesting authority must state at what degree of pressure the engine is to be worked.

Such pressure must not be exceeded.

The pressure must be stated in atmospheres, or in the number of pounds to each square inch of surface exposed to the pressure of the steam.

Art. 3. No high pressure boiler can be used unless it has been previously subjected to trial by the hydraulic press.

Every boiler must be proved at five times the pressure under which the engine supplied by it is to work.

Every boiler shall be marked after being proved, with a number, expressing the pressure under which it may be used, corresponding to the proof.

No individual shall use a boiler which is not marked with a number at least equal to that representing the pressure under which he has stated, in his declaration, that the boiler is to be used.

Art. 4. There shall be two safety-valves placed upon the top of every boiler, one at each end. The size and load of each shall be the same, and must be regulated, the former by the size of the boiler, the latter by the degree of pressure indicated by the proof-mark: the size of either valve will be so regulated that if raised alone, it may be sufficient to discharge the steam accumulated within the boiler.

The first valve shall be under the control of the engineer or fireman.

The second must be preserved from such control by being inclosed in a grating, of which the proprietor of the works, where the engine is used, shall have the key.

Art. 5. There shall in addition to these valves, be adapted to the top of each boiler two metallic plates, fusible at temperatures hereinafter to be stated.

The first of an area at least equal to that of one of the safety valves, shall be made of an alloy which shall melt, or soften so much as to yield to pressure, at 10 degrees of the Centigade thermometer, (18°F.) above the temperature corresponding to the proof-mark upon the boiler.

The second of twice the area of the first, shall be placed near and inclosed by the same grating, with the first safety valve: it shall be made of an alloy which shall fuse, or soften, at 20° C. (36 F.) above the proof-mark.

These plates shall be stamped with a number showing the degree of the thermometer at which they fuse.

Art. 6. No boiler shall be placed in an inclosure of less than twenty-seven times the capacity of the boiler.

The inclosure must be lighted, on two sides at least, by windows, closed by light shutters, opening outwards. It must not be contiguous to the walls of adjacent buildings, from which it must be separated by a wall of at least three feet thick, distant not less than two yards from the building. It must be separated by a wall of the same thickness from any interior workshop. There must be neither dwelling nor workshop above the boiler house.

Art. 7. The engineers of mines resident in the several departments, or in their default the government civil engineers, are charged with superintending the proving of the boilers, and fusible plates. They will stamp the proof numbers upon them with dies, which are to be furnished them for that purpose.

These engineers shall satisfy themselves, by inspection, at least once every year, that all the conditions prescribed are rigorously observed. They must examine the boilers, ascertain their condition, and cause to be thrown out of use, those which long continued wear, or accidental deterioration, may have rendered dangerous.

The local police authorities will keep a constant watch over the works using high pressure engines.

In case of non-compliance with the present ordinance, the proprietors of the works will be subject to a stoppage of the works, without regard to the penalties, damages, &c. which may be awarded by the courts of justice.

Art. 8. Our minister of the interior will cause instructions to be published, stating the precautions to be habitually observed in relation to high pressure engines.

These instructions must be posted up in the works.

Art. 9. Our minister of the interior is charged with the execution of this ordinance, which will be inserted in the Bulletin of Laws.

Given, &c. Oct. 29th, 1823.

[Signed,] Louis.

Corbierre, *Minister of the Interior.*

Instructions relating to the precautions to be observed in the use of High Pressure Steam Engines.

The use of high pressure engines requires constant care on the part of the engineers and firemen, and constant watchfulness on that of the proprietors. By neglecting the necessary precautions, the workmen may give rise to serious accidents, of which they themselves will be the first victims. By relaxing in vigilance the proprietors of the works may be the indirect cause of such accidents, besides exposing themselves to the losses which must result from the destruction of the engine, and to the injury which their business must suffer from the stoppage of work.

It is the duty of the proprietor to trust the direction of the engine to none but a man of tried intelligence and capacity, who is not only sober, and active, but who is also without any impediment to the regular discharge of his duty. Nothing should interfere with this regularity, nothing disturb or distract the attention of the engineer, otherwise there can be no security in the works.

The attention of the engineer and proprietor should be directed particularly to the following parts of the engine, viz: the furnace, the boiler, and boiler-tubes, the supply pipe, the level of the water within the boiler, the safety valves, the gauge. There are precautions to be taken also in relation to the inclosure containing the boiler.

The Furnace.

The principle according to which the heating should be regulated, is to avoid sudden changes of temperature, from cold to heat, or the reverse; in either case, the boiler is exposed to more or less considerable inequalities of temperature, which, on account of the variable expansions caused, may occasion cracks and leaks. Thus, on first getting up the steam, the fire should not be urged too much, particularly if the furnace has been entirely cold. Time would be gained only at the expense of the safety of the boiler. When the fire has been raised to a height adequate to supply steam for the working of the engine, it ought to be kept up uniformly; it should, therefore, be stirred at proper times, and supplied with just the requisite quantity of fuel, and no more. The fire must not be suffered to go down during the continuance of the work; and if this should happen, fuel must not be supplied hastily, and in great quantities; such a supply would at first produce a chilling effect, and afterwards give out an excessive and dangerous quantity of heat.

The stirring and replenishing should be performed quickly, so as to abridge the destructive action, which the cold air, introduced through the furnace door, would otherwise have, upon the boiler.

These precautions are not required when the self-regulating apparatus for feeding the furnace with coal, is used; in such a case the fireman must see that the hopper is supplied with coal, and that the supply from it is uniform and continuous.

Putting out the fire, when not carefully performed, is one great cause of the accidents which happen to boilers. The best method is to leave the unburned part of the fuel in the furnace, to close the register in the chimney, as well as the door of the ash-pit, and to stop up the crevices of this door, as well as of the furnace door, with clay. By proceeding thus, the sudden cooling of the boiler, and the rapid oxidation of its exterior surface, are avoided. Besides, the unburned fuel is turned to account; for, not having a supply of air, it goes out, and may be readily withdrawn from the furnace when it has cooled.

Of the Boiler.

However pure, water may seem to be, it deposits an earthy sediment which should not be allowed to accumulate. This deposit rapidly hardens, and increasing in thickness, it prevents the ready access of heat to the water within the boiler: thus, to supply the engine with steam, the fire must be raised, fuel is wasted, and the danger of decay and of bursting is increased.

Experiment has shown, that if potatoes in proper quantities be introduced within the boiler, the deposit is for a time prevented, the fecula of the potatoes keeping in suspension, the earthy sediment; but the viscous matter thus formed, as it increases in thickness, hinders the evolution of steam, and a period arrives, when its removal is indispensable; this period depends upon the nature of the water used. The proprietors of the engine should determine, by experiment, the proper period for cleansing the boiler, and also the least possible quantity of potatoes, if used, which will produce the desired effect. These investigations are required, not only by a regard to safety, but to economy; since the action of the fecula will retard the production of steam.

If, notwithstanding every precaution, a boiler-tube* should crack, the engineer ought, at once, to inform the proprietor of the fact, and the latter should instantly replace the cracked tube by a new one. Patching the tube would only conceal the mischief, and the danger of explosion would be incurred.

The proprietor and engineer should observe, attentively, the oxidation of the surfaces of the generating tubes, particularly if they be of cast iron. If they find reason to suspect that any of their boiler tubes are defective, they should prove them anew without waiting for the visit of the inspecting engineer. The same remarks apply to boilers; but as the means of observation are not so frequent, the engineer and proprietor should seize every occasion to ascertain the condition of the boiler; when, for example, one or more of the generating tubes are to be replaced—when repairs are to be made to the covering of the boiler, or when it is emptied to be cleaned, the indications afforded by leaks, should be carefully attended to.

---

* The tubes here referred to, are those below the boiler in Woolf's engine.

When a leak is found at the juncture of the boiler head with the boiler, or at the head of one of the generating tubes, no attempt should be made, while the engine is in action, to close the joint by tightening the screws; by so doing, a risk would be run of cracking the head; in the event of its giving way, the workman would be killed by the splinters, or scalded by the steam and hot water.

When the generating tubes, or boilers, are to be cleaned, the proprietors should not require their workmen to let off the water while yet hot, particularly when the boiler tubes have not stop-cocks attached to them.

Of the Supply Pump, and the level of the water within the Boiler.

When a float is used to show the level of the water within a boiler, it is of the greatest importance that the level should be kept at that indicated by the horizontal position of the lever, attached to the float. The engineer must not, however, trust entirely to the horizontal position of this lever, for information; he must satisfy himself that the motion of the float is perfectly free. He must especially be certain that the stuffing, through which the stem of the float passes steam-tight, does not press too closely upon the stem, preventing its free motion, and rendering inaccurate the indication afforded by the float.

The same precautions are necessary, when the float, by its depression, opens a valve through which water is supplied to the boiler as it is wanted.

The supply pump should be carefully attended to. If, from negligence, the level of the water within the boiler should become too low, as soon as it is ascertained, the supply should be gradually increased, otherwise accident may result. The water rising rapidly in contact with the sides of the boiler, which the fire may have heated, might produce so great a supply of steam, that the pressure would be too powerful for the boiler to withstand. The danger would be imminent if, in such a case, the safety valves were out of order, or overloaded.

If an explosion should not be produced by a defective supply of water, the least evil which could occur would be the fracture of the boiler.

Safety Valves.

In the engines where these valves are under the control of the fireman, he should study their play, and ascertain exactly what degree of adhesion they have to the valve seats. This adhesion must be attended to, even when the surface of contact is very small. The fireman should satisfy himself, by frequent trials, that these valves have the freedom of motion necessary to their perfect working. In order to this, he should raise, from time to time, the arm of the lever, to which is attached the constant weight with which the valve is loaded, to ascertain that the valve has not acquired an adhesion to its seat.

When the valves do not move freely, and when the maximum load which they are to bear, is placed upon them, they can fulfil their object but imperfectly; they confine the steam which should be suffered to escape; it accumulates, and may perhaps acquire an elasticity greater than that which the boiler can resist. This fatal effect might also be produced, if, in order to work the engine more rapidly, a weight has been added to that which constitutes the proper load of the safety valve. To overload the safety valve is exceedingly dangerous; ignorance of the danger incurred would constitute the only excuse for a proprietor who should order such a thing to be done, or for the engineer who should execute such an order. The firemen ought to be well aware, that one of the chief effects of an explosion would be to allow the escape of an immense quantity of hot water and steam, which would cause their death, or inflict extreme suffering.

Such accidents are much less to be feared in engines established in conformity with the royal ordinance of October 29, 1823, but the safety valves should not the less be watched, and kept perfectly free. In fact, if their play were stopped, ever so little, it would happen, upon the least increase of the fire, that the steam, instead of escaping, would accumulate, increasing in both temperature and elasticity; it would, after a time, melt the fusible plates applied to the boiler, the working of the engine would be thus stopped, and the proprietor must incur the inconvenience of the delay incident to the replacing of this plate. The proprietor should specially visit every day the valve under the grating of which he has the key. The valves should be ground very frequently, otherwise they will suffer the steam to escape. The necessity of keeping them in order is imperative, for the workmen can only render them tight by increasing the load upon them, and the proprietor cannot too strictly prohibit their being overloaded.

When the fire is left to burn out, or when it is covered up, in order to be relighted the next day, the workshop should not be left, before it is ascertained that the safety valves are unloaded, so as to permit the steam, which is still produced to escape freely.

Of the Steam Gauge.

The gauge, being connected with the interior of the boiler, shows always the rate at which steam is generated, and the degree of pressure produced by it. The variation of pressure is shown by the motion of the mercurial column in the glass tube, and the amount is measured by the scale attached to this tube.

This instrument, when properly constructed, is of the greatest utility: to preserve it from accident, it should be enclosed in an iron, or brass, wire grating.

The proprietor should ascertain that his engine-men are duly sensible of the advantages of this instrument, and understand the manner of using it.

It is the duty of the fireman to consult the gauge very frequently, and to be guided by its indications in regulating the fire, whatever may be the resistance, arising from the work to be done, against which the machine is acting.

Of the Inclosure containing the Engine.

In order to render the effects of explosion, should such accidentally occur, less dangerous, the boiler-house must be completely insulated. The materials stored in the works should not be deposited within several yards of it. The proprietor would violate the 6th art. of the royal ordinance of Oct. 29, 1823, if he should fill the space between the neighbouring buildings and the wall about the boiler-house, with resisting materials. This wall cannot answer the purpose of that ordinance unless it has an open space around it.

Finally, it is indispensably necessary that the boiler-house should be kept under lock, so that, in the absence of the fireman, no one can have access to it. We may imagine that if the safety valves should be overloaded, or kept down by wedging, after the fire has been covered up, the accumulation of steam might occasion an accident; precaution is as necessary in this case as in those dwelt upon above. The superintending care of the proprietor, and the vigilance of the engineer, should never be wanting at any time or under any circumstances.

(Signed,) BECQUEY,

Counsellor of State, and Director General of Civil Works and Mines.

Paris, 9th March, 1824.

Circular of April 1*st,* 1824, *to the Prefects of Departments.*

SIR,—You have been made acquainted with the royal ordinance of October 29th, 1823, relating to high pressure engines. According to the 8th art. of that ordinance, the instructions in reference to the precautions to be observed in the use of these engines, must be printed and posted up in the workshops.

The engineers of mines of the department, or, in their default, the government civil engineers, having been charged, by art. 7, with executing the principal parts of that ordinance, I assembled a board, composed of those members of both corps best acquainted with the subjects committed to them, and requested them to prepare a set of instructions in relation to the measures of precaution to be habitually observed, in the use of the high pressure engine. These instructions were approved on the 19th of last March, by his excellency, the minister of the interior.

I have the honour to transmit — copies. You will please to have the instructions printed, and posted up in workshops where there are engines, which come under the terms of the first art. of the ordinance of October 29th.

You will also transmit copies to the proprietors of engines, requesting them to make abridged extracts from them, applicable to the kind of engine which they use.

I am now preparing materials for a second set of instructions, in relation to the execution of the 3d, 4th, and 5th articles of the ordinance; these articles refer to the proof to which the boilers must be subjected, to the valves to be applied to each end of the top of the boiler, and to the two fusible plates intended to prevent explosions.

I shall have dies made, to be sent to the engineers whose duty it is to have marked upon every boiler, the degree of pressure with which it has been calculated to work, and according to which the proof has been made, as also, the temperature at which the metal plates attached to the boiler are fusible.

Under existing circumstances, to secure manufacturers as much as possible from accident, I beg you to attend at once to the execution of art. 6th of the ordinance, according to which a boiler must not be placed in an enclosure of less than twenty-seven times the capacity of the boiler.

The enclosure must be lighted on two sides at least, by windows closed by light shutters opening outward. It must not be contiguous to the walls of adjacent buildings, from which it must be separated by a wall of at least three feet thick, distant two yards from the building. It must be separated by a wall of the same thickness from any interior workshop. There must be neither dwelling nor workshop above the boiler-house.

I shall have the honour to transmit hereafter to you, and to the engineers of mines, and civil engineers, new instructions in relation to the valves, the fusible plates, and the application of the dies, &c.

(Signed,) Becquey,

Counsellor of State, and Director General of Civil Works and Mines.

On the Disease, called Painter's Colic, to which certain Trades are liable.

We have extracted from the valuable work on Poisons, by Dr. Christison, of Edinburgh, an account of the disease, known as the painter's colic, to which certain trades are liable. The article contains a plain statement of the causes producing the complaint, and of the precautions necessary to prevent their action.

Dr. Christison commences with some observations on the various ways in which lead enters the system, which we do not think it necessary to extract, and then proceeds to make the following remarks on the trades which expose workmen to its influence.

[Com. Pub.

The most accurate information on this subject is contained in the work of Mérat. He places foremost in the list, miners of lead. In this country miners are now rarely affected, because the frequency of colica pictonum [painter's colic] among them formerly, lead their masters to study the subject, and to employ proper precautions for removing the danger. It has been stated by Dr. Percival, and is generally thought, that the whole of the workmen in lead mines are apt to be attacked with the colic,—those who dig the sulphuret, as well as those who roast the ore.* If this idea were correct, it would be in contradiction with the general principle in toxicology, that the metals are not poisonous unless oxidated. But the opinion is in all probability founded on error; for I am informed by *Mr. Braid*, who was some years surgeon at Leadhills in Lanarkshire, that the workmen who dig and pulverize the ore there, although liable to various diseases connected with their profession, and particularly to pectoral complaints, never have the lead colic until they also work at the smelting furnaces. Next to miners may be ranked manufacturers of litharge, red lead, and white lead. The workmen at these manufactories are exposed to inhale the fumes from the furnaces, or the dust from the pulverizing mills. It is chiefly among the workmen of a white lead manufactory in the neighbourhood of Edinburgh that I have had an opportunity of witnessing the lead colic. By a simple change the proprietor lately made in the process, and which will be mentioned presently, the disease has been almost extirpated.

Next in order, perhaps among the same class with colour-makers, are house painters. The cause of their liability is the great quantity of the preparations of lead contained in the paints they use. It would appear that lead colic is most frequent among people of that trade in cities of the largest size. In Geneva, I am informed by my friend *Dr. C. Coindet* of that place, colica pictonum is now almost unknown, and never occurs among painters. In Edinburgh it is also little known among painters. A journeyman painter, a patient of mine in the infirmary, had been seventeen years in the trade, and yet did not know what the painter's colic, or lead palsy, meant. In London, according to the dispensary reports, and in Paris, according to the tables of Mérat, many workmen of the trade suffer. I have been informed by an intelligent workman, once a patient of mine, who had been a journeyman painter both in London and in Edinburgh, that the number of his acquaintances who had been affected with the colic in the metropolis was incomparably greater than here. This man ascribed the difference to the working hours being more in the former place, so that the men had not leisure enough to make it worth their while to clean themselves carefully in the intervals. This appears a very rational explanation. I do not know how the great prevalence of colic among painters in Paris is to be accounted for. Plumbers, sheet-lead manufacturers, and lead pipe makers, are also, for obvious reasons, apt to suffer, but as they are not necessarily exposed to the vapours of lead, and suffer only in consequence of handling it in the metallic form, it ought to be an easy matter to protect them. They themselves conceive that a very hazardous part of their occupation is the removing of the melted lead from the melting pot to make the sheets or pipes; but this operation is not dangerous if the melting pots are properly constructed. A few cases of lead colic occur among glass-blowers, glaziers, and potters, who use the oxide of lead in their respective manufactures. There are a few also among lapidaries, and others, who use it for grinding and polishing stones or metals, and among grocers and colourmen who sell its various preparations. Printers are rarely attacked with the colic, but they are generally considered to be subject to partial palsy of the hands, which is ascribed to the frequent handling of the types. I have met with one case apparently of this nature. Lead is not the only metal to which the power of inducing colica pictonum has been ascribed. *Mérat* has mentioned several instances of the disease occurring among brass-founders and other artisans who work with copper.* *Tronchin* quotes Scheuchzer for a set of well-marked cases which happened in a convent of monks, and where the malady was supposed to have been traced to all the utensils for preparing and keeping their food, having been made of untinned copper.† The same author mentions two cases, one of which came under his immediate notice, where the apparent cause was the long-continued use of antimonial preparations internally.‡ Mérat has likewise found a few iron-smiths and white-iron-smiths in the list kept at one of the Parisian hospitals.§ Cases of colica pictonum have even been noticed by Mérat among varnishers, plasterers, quarrymen, stone hewers, marble workers, statuaries, saltpetre makers;‖ and Tronchin enumerates among its causes the immoderate use of acid wine or of cider, checked perspiration, sea scurvy, melancholy. But the only substance besides lead, whose operation in producing colica pictonum has been traced with any degree of probability, is copper; and even among those artisans who work with copper the disease is very rare. As to the other tradesmen mentioned by Mérat, it is so very rare among them, that we may safely impute it, when it does occur, to some other cause besides what the trade of the individual exposes him to; and in general the secret introduction of lead into the body, may be presumed to be the real origin of his malady. Still, however, the connexion of colica pictonum with other causes besides the poison of lead, is upheld by so many facts, and is believed by so many authorities, that this disease cannot be safely assumed, even in its most characteristic form, as supplying undoubted evidence of the introduction of lead into the system.

---

* On the Poison of Lead, p. 22.

The work of Mérat contains some interesting numerical documents, illustrative of the trades which expose artisans to colica pictonum. They are derived from the lists kept at the hospital of La Charitè in Paris, during the years 1776 and 1811. The total number of cases of colica pictonum in both years was 279. Of these 241 were artisans, whose trades exposed them to the poison of lead, namely, 148 painters, 28 plumbers, 16 potters, 15 porcelain-makers, 12 lapidaries, 9 colour-grinders, 3 glass-blowers, 2 glaziers, 2 toy-men, 2 shoemakers, a printer, a lead-miner, a leaf-beater, a shot manufacturer. Of the remainder, 17 belonged to trades in which they were exposed to copper, namely, 7 button-makers, 5 brass founders, 4 brasiers, and a copper-turner. The remaining twenty-one were tradesmen, who worked little, if at all, with either metal, namely, 4 varnishers, 2 gilders, 2 locksmiths, a hatter, a saltpetre-maker, a wine-grocer, a vine-dresser, a labourer, a distiller, a hatter, a stone-cutter, a calciner,* a soldier, a house servant, a waiter, and an attorney's clerk. Age or youth seems not to afford any protection against the poison. Of the 279 cases, 24 were under 20, and among these were several painter-boys, not above fifteen years old; 113 were between nineteen and thirty; 66 between twenty-nine and forty; 38 between thirty-nine and fifty; 28 between forty-nine and sixty; and 10 older than sixty. These proportions will correspond pretty nearly with the relative number of workmen of similar ages. Among the 279 cases, fifteen died, or 5.4 per cent.

---

* De la Colique Metallique.

† De Colica Pictonum, p. 56.

‡ De Colica Pictonum, p. 65.

§ De la Colique Metallique, p. 23.

‖ De la Colique, Passim.

* * * * *

The mode of preventing the influence of the poison becomes a subject of great importance; and more particularly when we consider the vast number of workmen in different trades, whose safety it is calculated to secure.

On this subject many useful instructions are laid down in the work of *Mérat*. He very properly sets out with insisting on the utmost regard being paid to cleanliness,—a point too much neglected by most artisans, and neglected particularly by those to whom it is most necessary, the artisans who work with the metals. In proof of the importance of this rule he observes, he knew a potter who contracted the lead colic early in life, when he was accustomed to go about very dirty, but for thirty years after had not any return of it, in consequence simply, of a scrupulous attention to cleanliness. In order to secure a due degree of cleanliness, three points should be attended to. In the first place the face and hands should be washed once a day at all events, the mouth well rinsed and the hair occasionally combed. Secondly, frequent bathing is of great consequence, both with a view to cleanliness and as a general tonic; so that masters should make it an object to provide their workmen with sufficient means and opportunities for practising it. Lastly, the working clothes should be made, not of woollen, but of strong, compact linen, should be changed and washed at least once, and still better twice, a week, and should be worn as little as possible out of the workshop. While at work a cap of some light impervious material should always be worn.

Next to cleanliness, the most important article of the general prophylaxis, relates to the means to be employed for preventing the food of the workmen from being impregnated with lead. For this end it is essential that they never take their meals in the workshop, and that before eating they wash the lips and hands with soap and water, and brush out all particles of dirt which may have lodged under the nails. It is also of some moment that they breakfast before going to work in the morning.

Derangements of the digestive organs should be watched with great care. If they appear to arise from the poison of lead, the individual should, with the very first symptom, leave off working and take a laxative. Habitual constipation should be provided against.

---

* *Calcineur*,—a calciner of gypsum, I believe.

The nature of the diet of the workmen is of some consequence. It should be as far as possible of a nutritive and digestible kind. There is some reason for believing that the free use of fat and fatty articles of food is a preservative. *Dehaën* was told by the proprietor and physician of a lead mine in Styria, that the work people were once very liable to colic and palsy, but that, after they were told by a quack doctor to eat a good deal of fat, especially at breakfast, they were exempt from these diseases for three years.* Another fact of the kind was communicated to *Sir George Baker*, by a physician at Osterhoüt, near Breda. The village used to be the residence of a great number of potters, among whom he did not witness a single case of lead colic in the course of fifteen years, and he attributes their immunity to their having lived much on cheese, butter, bacon, and other fatty kinds of food.† Mr. Wilson says, in his account of the colic at Lead-hills, in Lanarkshire, that English workmen, who live much on fat meat, suffer less than Scotchmen, who do not.‡

Some have likewise proposed, as an additional preservative, that the exposed parts of the body should be anointed with oily or fatty matters. But *Mérat* maintains with some reason, that the lead will be thereby enabled to penetrate the cuticle more easily by friction and pressure.

The observance of the preceding rules will depend, of course, in a great measure, on the intelligence and docility of the workmen, directed by the vigilance and authority of their masters.

Some other objects, also of much consequence, are to be attained by the humanity and skill of the masters only.

The workshop should be spacious, and both thoroughly and systematically ventilated; the external air being freely admitted when the weather will allow, and particular currents being established, by which floating particles are carried through the workshop in certain invariable and known courses. Miners, and others who work at furnaces in which lead is smelted, fused, or oxidated, should be protected by a strong draught through the furnaces. Mr. Braid informs me, that wherever furnaces of such a construction have been built at Lead-hills, the colic has disappeared, while it continues to recur where furnaces are still used of the old, low-chimneyed, form. Manufacturers of litharge and red lead, used formerly to suffer much in consequence of the furnaces being so constructed, as to compel them to inhale the fine dust of the oxides. In drawing the furnaces the hot material is raked out upon the floor, which is two or three feet below the aperture in the furnace; and the finer particles are therefore driven up and diffused through the apartment. But this obvious danger is now completely averted by a subsidiary chimney, which rises in front of the drawing aperture, and through which there is a strong current of air attracted from the apartment, the hot material on the ground performing the part of a fire.

---

* Ratio Medendi, p. 1. c. 9. de Variis.
† Trans. of London Coll. of Phys. 2. 457.
‡ Ed. Phys. and Lit. Ess. 1. 521.

In white lead manufactories a very important and simple improvement has been effected of late, in some places, by abandoning the practice of dry grinding. In all manufactories of the kind, the ultimate pulverizing of the white lead has been long performed under water. But in general, the preparatory process of rolling, by which the carbonate is separated from the sheets of lead on which it is formed, continues to be executed dry. This is a very dangerous operation, because the workmen must inhale a great deal of the fine dust of the carbonate. In an extensive white lead manufactory at Portobello, the process is entirely performed under water, or with damping; and to this precaution, in a great measure, are imputed the improvement which has taken place in the health of the workmen, and their superior immunity from disease, over those of Hull and other places, where I am informed the same precaution is not taken.

The only operation now considered dangerous at the Portobello works, is the emptying of the drying stove, and the packing of the white lead in barrels; and the dust which is then diffused is kept down as much as possible, by the floor being maintained constantly damp. By these precautions, and by care being taken to make the workmen wash their hands and faces before leaving the works for their meals, and to administer a brisk dose of castor oil on the first appearance of any complaint of the stomach or bowels, the manufacturer succeeded in extirpating the colica pictonum entirely for several years. Last year it appeared again to a limited extent among the work people, apparently in consequence of the rules as to cleanliness, not having been so carefully enforced.

Remarks on the Different Modes of Applying power for Locomotive Purposes.

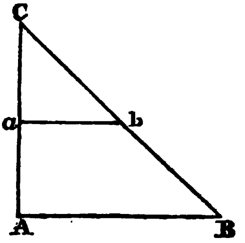
(Concluded from page 262.)

Before leaving the subject, it may not be reckoned improper to estimate the facilities which the condensed air system affords to locomotion on common roads. It has already been observed, that the various inconveniences and obstacles which present themselves in regulating the supply of steam power to meet an ever-varying opposing force have, as yet, entirely prevented its effectual application on common roads. By applying a reservoir of condensed air, however, and the necessary apparatus of communication, this hinderance is removed, and in every case of expenditure the greatest economy is introduced. To gain a complete knowledge of its expediency, it therefore only remains to have an accurate notion of the additional weight of the reservoir and machinery requisite to retain, with most perfect safety, the necessary quantity of power. To avoid circumlocution, these several advantages may be conveniently displayed in the form of a table, which is arranged in the following manner:—

1	2	3	4	5	6
Height of Ascent.	Contents of Reservoir in Cubic feet.	Diameter of Reservoir in Feet.	Thickness of Reservoir in Inches.	Weight of Reservoir in lbs. Avoird.	Horizontal Length in Miles.
0	65.710	4.035	.605	1238	10.000
50	66.954	4.061	.609	1262	10.189
100	68.198	4.086	.613	1287	10.379
150	69.442	4.110	.616	1311	10.668
200	70.686	4.135	.620	1336	10.758
250	71.930	4.160	.624	1360	10.947
300	73.174	4.183	.627	1384	11.137
350	74.418	4.204	.631	1408	11.326
400	75.662	4.228	.634	1432	11.516
450	76.906	4.252	.638	1455	11.705
500	78.150	4.277	.641	1477	11.896
550	79.394	4.298	.645	1499	12.084
600	80.638	4.320	.648	1520	12.274
800	85.614	4.408	.661	1615	13.032
1000	90.590	4.491	.674	1709	13.790
1500	103.030	4.688	.703	1936	15.685
2000	115.470	4.870	.730	2176	17.580
2357	124.352	5.000	.750	2356	18.932

The first column presents the height in feet which has to be overcome, and is equal to the sum of the height of all the inclinations of ascent, which is gone over in the horizontal distance of 10 miles. The second shows the number of cubic feet of air, having 50 atmospheres' condensation contained in the reservoir, being 5 times the quantity of power necessary to impel the loaded coach, reservoir, and machinery, estimated at 6 tons, over a horizontal distance of 10 miles (the force of traction being estimated at $\frac{1}{20}$ the whole load,) and up ascending inclinations, the sum of the vertical heights of which are considered variable, and denoted by the figures in the first column. The quantities in this column are calculated from the formula $SW = \frac{15 A^2 C}{2}$, already explained and demonstrated. The third column shows the corresponding diameters of the reservoir, considered as a spherical shell. The fourth column shows the requisite thickness of the reservoir—supposed to be malleable iron—having a cohesive force of 75,000 lbs. to the square inch, one-fifth of which being taken as the quantity M in the formula $t = \frac{pD}{4M}$ (see note A,) from which the figures in this column were calculated. The fifth column represents the corresponding weight of the reservoir, a cubic foot of the iron being supposed to weigh 480 lbs; the formula being $\frac{480 \times 3.1416 \times D^2 t}{1728} = D^2 t \times .873 =$ weight in lbs. The figures in the sixth or last column, represent the respective distances to which the coach would proceed on a level road, having a reservoir with dimensions, &c. as specified in the foregoing columns.

This table appears to show satisfactory evidence of the practicability of this system on common roads, and the only difficulty which can remain to lead to different conclusions is the uncertainty of an efficient mode for the direct application of the power. If this were discovered, and all the practical difficulties removed, it must be encouraging to reflect that a coach, weighing 6 tons, including a reservoir of condensed air, 5 feet in diameter, and weighing one ton, could move at almost any velocity over a distance of 17 miles, and ascend inclinations having a total vertical height of 1500 feet. (Note B.)



(Note B.)—To the great velocity to which locomotive steam carriages aspire, the resistance of the air must prove a serious obstacle. Of late a speed of 40 or 50 miles an hour is said to have been attempted—it will be interesting to calculate the exact amount of this resistance. A body descending by the force of gravity continually receives new impressions, equal in equal times, which introduces an equably accelerated velocity. This velocity continually increasing, may be represented by one side, AB, of a triangle, whilst the other side, AC, may represent the time elapsed since the commencement of the motion, which likewise undergoing a simultaneous increase, AB will always be proportional to AC. In ascertaining the resistance of air, the pressure of this resistance is to be compared with the force of gravitation. With regard to the former we have to observe, that the velocity being uniform, the quantity of matter varies; let AC, in this instance again, represent the time, and AB the distance gone over in this time, or the quantity of air which impinges against the carriage. It is evident, that in a small instant *a*C the velocity being uniform, the quantity of air which has impinged during the lapse of this instant is proportional to *a*C, and may be represented by *ab*, which is to *a*C::AB.AC. In gravitation, therefore, the quantity of matter is constant, the velocity increasing with the time, whilst in the resistance of air or any other fluid the velocity is constant whilst the matter augments with the time. If then in equal time AC.AC, the two products AB.AC, AB.AC, are equal, the pressure and resistance mutually balancing each other, an equilibrium will take place. This may be understood likewise from considering that momentum of every kind is compounded of the velocity of the moving body, and the quantity of matter which is in this body, both being equally necessary to the production of motion, if in one case the velocity augments whilst the quantity of matter is constant, the resulting momenta are the same as if the quantity of matter increased in an equal ratio and the velocity remained constant. To illustrate this by a practical example, we may attempt by this method to calculate the resistance of a square foot of surface moving in air at the velocity of 30 miles an hour. Assuming the specific gravity of air as ·0012, water being 1, and a cubic foot of it weighing 62½ lbs. the distance moved over in a second will be $\frac{30\times5280}{3600}=1.47\times30=44$ feet, and the quantity of matter impinging in that time $=44\times.0012\times62.5=3.3$ lbs. the product of this quantity by 44 (or the velocity,) and divided by 32 17 (the force of gravity) will give the number of pounds pressure on the square foot, or $\frac{44\times3.3}{32{\cdot}17}=4.536$ lbs. In this manner, A representing the velocity in miles per hour, we obtain the formula $\frac{\left(\frac{A\ 5280}{3600}\right)^2 .075}{32.166}=.00504\ A^2$ lbs.=the pressure on a square foot of surface moving in air at the rate of A miles an hour.—See Table in the following page.

Surely such conclusions afford the greatest encouragement for a practical trial of the system; and if found to succeed, the advantages to be derived from its application must prove incalculable. The steam-engine would acquire double value and efficacy, and, from its superior economy and convenience, might tend to abridge, and finally abolish, every description of animal labour. Altogether, the subject, however much at present it wants the aid of practical experience, is not unworthy of public attention, and from the eminent good which is likely to spring from it, seems well calculated to excite the efforts of ingenious and enterprising engineers. The object of the foregoing remarks has chiefly been to rouse the attention of your correspondents to the subject. A patent has been taken out by a gentleman in Wales for this mode of stowing and applying power, but not having heard of its having, as yet, undergone any experimental trial, it would be highly interesting if any of your readers could supply any information upon this subject, and would much oblige, sir, your obedient servant,

Edinburgh, Nov. 1830. N. S. N.

Miles per Hour.

Square feet of opposing resistance.

	1	4	8	12	16	20	24	28	32	36	40
1	.00504	.02016	.04032	.06048	.08064	.10080	.12096	.14112	.16128	.18144	.29160
5	.126	.504	1.008	1.512	2.016	2.520	3.024	3.528	4.032	4.536	5.040
10	.504	2.016	4.032	6.048	8.064	10.080	12.096	.14112	16.128	18.144	20.160
15	1.134	4.536	9.072	13.608	18.14	22.68	27.22	31.75	36.29	40.82	45.36
20	2.016	8.064	16.13	24.19	32.26	40.32	48.38	56.45	64.51	72.58	80.64
25	3.150	12.60	25.20	37.80	50.40	63.00	75.60	88.20	100.8	113.4	126.0
30	4.536	18.14	36.29	54.43	72.58	90.72	108.86	127.01	145.15	163.30	181.4
35	6.174	24.70	49.39	74.09	98.78	123.5	148.2	172.9	197.6	222.3	247.0
40	8.064	32.26	64.51	96.77	12982	161.28	193.54	225.8	258.1	290.3	322.6
45	10.21	40.8	81.65	122.47	163.3	204.1	245.0	285.8	326.6	367.4	408.2
50	12.60	50.4	100.8	151.2	201.6	252.	302.4	352.8	403.2	453.6	504.0

[*Mechanics' Magazine.*

To our Readers.

We are promised that a further portion of the Report of the Committee on Water Power will be in readiness to present to our readers in the number for June next: the nature of the calculations must necessarily produce intervals between the appearance of the different parts of this Report.

COMMITTEE ON PUBLICATIONS.

Meteorological Observations for March, 1831.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain and snow.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2, P.M.	Direction.	Force.		
				Inches	Inches.			Inches.	
	1	30°	54°	30.15	30.15	W. W.	Calm.		Clear. Clear.
	2	38	58	.26	29.95	W. S.	do.	.02	Clear—*river open*—rain.
	3	46	54	29.93	.83	W. W.	Moderate.		Clear. Cloudy.
	4	34	48	.90	.92	W. SW.	do.		Clear. Cloudy.
	5	44	62	.80	.85	W. W.	do.	.19	Cl'dy-cl'dy-rain in night.
☾	6	48	43	.85	.84	S. S.	do.	.17	Cloudy—cloudy—rain.
	7	30	49	.70	.70	SW. W.	Blustering.	.01	Fog—flying clouds—rain.
	8	30	43	.90	30.00	W. W.	Moderate.		Clear—flying clouds.
	9	30	50	.95	29.80	S. S.	do.	.01	Cl'dy—clear—slight rain.
	10	32	44	.80	.85	W. W.	do.		Clear. Clear.
	11	29	50	30.00	30.00	SE. S.	do.		Clear—white frost—clear.
	12	37	58	29.80	20.70	SW. S.	do.		Cloudy. Cloudy.
	13	32	52	.53	.50	W. W.	Blustering.		White frost-fog-fly. cl'ds.
⊗	14	32	42	.65	.75	do.	do.		Clear—flying clouds.
	15	31	56	.75	.83	do.	Moderate.		Clear. Clear.
	16	48	48	.65	.65	SW. W.	do.		Cloudy cloudy—drizzle,
	17	34	26	.60	.60	SE. NW.	Blustering.	.16	Cloudy—snow squall.
	18	20	38	30.20	30.20	W. SW.	Moderate.		Clear. Clear.
	19	34	43	29.74	29.60	S. W.	Blustering.	.20	Rain—flying clouds.
☽	20	29	38	.72	.83	W. W.	do.		Clear. Clear.
	21	23	43	30.15	30.25	do.	Moderate.		Clear. Clear.
	22	29	54	.25	.25	do.	do.		Clear—white frost—clear-
	23	39	63	.15	.15	SW. S.	do.		Cloudy—hazy. [lun. halo.
	24	49	60	.09	29.90	S. S.	do.	.35	Rain—thunder shower.
	25	56	64	29.63	.63	W. W.	do.		Flying cl'ds—flying cl'ds.
	26	48	62	.70	.70	W. SW.	do.		Clear. Clear.
	27	47	64	.60	.60	S. W.	Blustering.	.66	Clear. Clear.
☺	28	44	54	.90	.95	N. NE.	Moderate.		Clear. Overcast.
	29	41	44	.90	.80	E. SE.	do.		Rain. Rain.
	30	47	48	.40	.25	SW. W.	Blustering.	1.30	Fog—rain—cloudy.
	31	41	68	.70	.60	SW. S.	do.	.04	Clear—clear—shower in the evening.
	Mean	37.45	50.96	29.85	29.83			3.11	

	Thermometer.	Barometer.
Maximum height during the month,	68. on the 31st	30.26 on the 2nd.
Minimum do. . .	20. on the 18th, . .	29.25 on the 30th.
Mean do.	44.20	29.84

Water fallen in snow and rain, 3.11 inches.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1831.

Remarks on the effect of Salt Water in Steam Engine Boilers, and on some other points relating to their structure and use: extracted from a letter to the Editor, written by a gentleman in Boston.

The Committee of the Franklin Institute having expressed a desire to have information of any facts connected with the causes of explosion in boilers, I offer the following, which, although not an instance of explosion, is connected with the subject. A boat was repaired in this place to ply about the harbour. A new boiler of nearly ¼ inch iron was put into it; the fireman soon began to complain that he could not keep up the steam, and the difficulty increased until it was found impossible to raise power enough to drive the boat more than three or four knots an hour, although the furnace was abundantly supplied with fuel, which was thoroughly ignited. At length the boiler began to leak in such quantity as to extinguish the fire, a large rent having been made in the bottom of it. It was found that the part immediately exposed to the flame had bilged outwards, and it appeared to have been so much heated as to have approached a state of fusion. On examining the interior, there was found a deposition of salt and other solid matter, which had accumulated to upwards of two inches in thickness. I have now in my possession a piece of the sediment two inches through. This deposition was effected in less than 20 days, and only, as I was informed, because the *engineer was not aware of the probability of such an occurrence*, nor of the importance of frequently *blowing out* the boiler, when salt water is used. The statement of this fact induces me to repeat a hint contained in the following extract from a communication in the Boston Evening Gazette, 5th June, 1825.

"We close with a suggestion, which, if adopted, may add one more to the safeguards recommended by others. Fully persuaded, that much of the evil there is so great reason to lament, has arisen from confidence in unqualified persons, we think it would be a good plan to establish a board of examination in all places where steam engines are much used, and to pass a law prohibiting, under severe penalties, the engaging of any person as an engineer who was not furnished by the board where he sought employment, with a certificate of his being *morally and intellectually* qualified for the duty.

"If the awful consequences had not rendered the subject too solemn, we should certainly feel disposed to indulge in a little levity at the expense of that class of men so ridiculously and preposterously dubbed engineers. This is, in our estimation, a designation implying ability, study, and practical skill. Whether these qualities are usually possessed, let those decide who have had an opportunity of judging. Has it not frequently happened that men have been taken from the work bench, and, if they had barely understanding enough to oil a gudgeon, drive a wedge, or screw up a nut, have been thought adequate to a most responsible duty, on a faithful and intelligent discharge of which, depended the happiness of thousands?

"The plan proposed, or something similar, would, in our opinion, furnish a remedy for this part of the evil."

The preceding may contain nothing new, or, if new, nothing useful; if so, it will only add one to the number of idle things already written on this subject, and I must apologize for the trouble and loss of time its perusal has occasioned. In stating the fact respecting the destruction of a boiler, by the deposite of saline and other matter, I have merely intended to add one to numerous others, which lead to the belief that accidents probably arise more from carelessness and ignorance, than from any *mysterious* operations of steam. Since writing it, other similar cases have come to my knowledge, all relating to boats employed in this harbour. In these instances, which are three in number, the boilers were destroyed in a very short time by concretions on the interior. On examining one boiler, a sediment six inches thick was found. The engineer, who had the care of it, was warned of the danger, and the necessity of guarding against it, but "knew better." Another instance of injury arising from inattention, or want of knowledge, happened last summer in a boat on Connecticut river. While in operation, its movements became gradually slower, until it entirely ceased. The constructor being on board, descended to the fire room, to ascertain the cause; he turned the gauge cocks, but no water issued, and on looking into the furnace, he discovered that the whole bottom of the boiler was at nearly a white heat. Knowing what ought to be done on such an emergency, he immediately extinguished the fire, and waited until the boiler had cooled down, before he permitted water to be injected; but his *engineer*, as he acknowledged, would have poured water into it, had there not been some obstruction in the pipes, and would no doubt have blown both boat and passengers out of existence.

Here are accidents, harmless indeed, excepting in the loss of time and money, in which the cause of injury is obvious; and, generally speaking, the cause lies no deeper than in the instances cited, wherever it has been accurately traced. A correct and satisfactory narrative of facts connected with those awfully destructive explosions which have so strongly excited the public sympathy, can rarely be obtained, nor indeed can it be reasonably expected. They who *could* give correct information, are usually placed beyond the reach of inquiry; and they who survive, and *should* know, are too much interested in palliating their own misconduct, to furnish candid representations. Our judgment, then, must be directed by those occurrences whose origin cannot be concealed, whatever motive may exist for secrecy or deception. Adopting these as our guides, the main sources of danger are readily discovered; but are not these too much neglected? Is there not, in seeking for the causes of explosions, too great a disposition to refinement? Is not scientific vanity taking the place of an unostentatious pursuit of simple truth? There appears to be an ambition to discover a supposed mysterious property or condition of steam, whose development is to be the basis of distinction and extended fame. In this spirit, a vacuum has been imagined *under* the water, and safety air valves to the *bottoms* of boilers, have been soberly recommended. Let practical science and skill be first devoted to the devising of remedies for known evils, and the imagination may afterwards flutter about at leisure in the regions of speculative theory. When the visible difficulties which encumber the surface are cleared away, there will be much less perplexity and uncertainty, in discovering and removing those which are more deeply seated.

It appears very plainly that the safety valve, as usually constructed, rarely preserves the attributes which its name imports. Instead of being so designated, it should be christened anew, and called the *Betrayer*. Not a boiler has been burst, not a boat disabled, not a limb mangled, nor a life destroyed by steam, that has not been placed under the protection of this false guardian. All its promises of security are treacherous, and the confidence which has been placed in it has been rewarded by excruciating suffering, or death. The experiments of Clement, prove that it cannot be relied upon; in vain is it urged by the raging steam, to perform the duties to which it is pledged, and to open a free passage for the escape of the destroyer. Having taken its stand, it resists all pressure, and maintains its position with a pertinacity proportioned to the force applied to drive it off. I have devised some plans which I fondly hope will be found effectual to correct this perversity of disposition, and give a more *amiable* trait of character, if possible, to this interesting appendage to the steam engine. To effect this object, it is necessary that a regular supply of water should be insured in the boiler, and this also I hope to attain. I am aware, however, that it is much more easy to draw plans upon paper which shall have a very promising appearance, than it is to construct instruments which shall perform the duties which we may assign to them. I have, therefore, determined to adopt the wise plan of a fair practical experiment, before presenting you with diagrams of my apparatus; and should I succeed, according to my intentions and anticipations, you shall again hear from me.

R. D. H.

Boston, March 21, 1831.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Splicing a Water Wheel Shaft.

Respected Friend,—Deeming it the duty of every one to disseminate that knowledge which experience or observation may supply, and which appears calculated to conduce to the prosperity of the arts and manufactures of our country, we send the following notice of an expedient to which we have resorted, in repairing the shaft of a water wheel, leaving thee at liberty to make such use of it as may appear best.

Having occasion to renew one of our water wheel shafts, last summer, and desirous of avoiding the great difficulty and expense attending the procuring and fixing a piece of timber of sufficient length, the idea of splicing it occurred to us, as, upon examination, the water end appeared to be perfectly sound. We procured a short piece of timber, and coupled it to the sound part by means of a gudgeon and sleeve, and have found it to answer the purpose well, with a very trifling increase of the friction. The advantage of this plan is, that of procuring a short shaft instead of a long one; which may be again replaced, as the wet end will last for a very long period, whilst the other will not be so subject to the dry rot.

With respect,

J. & S. P. Gilpin.

Triadelphia, Montgomery county, Maryland, April 2, 1831.

Remarks on some erroneous statements made by Mr. J. Shaw, in his "Observations on a Patent obtained by Lieutenant Bell, for a Percussion Lock."

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

In the Journal for February last, there is an article, communicated by Joshua Shaw, relating to percussion locks for cannon, which contains imputations of a highly dishonourable character upon the conduct of Lieutenant W. H. Bell, of the United States army. The facts alleged in that article, are, in substance, that Lieut. Bell, by insidious means, obtained the particulars of an original and important invention from Mr. Shaw, the inventor; and, that he afterwards endeavoured to appropriate the credit of this invention to himself, by obtaining a patent for it, as an original discovery of his own.

These are serious charges, and the article states that they can be sustained by the "most unimpeachable evidence." If they could be thus sustained before a competent tribunal, it would cost Lieut. Bell his commission, and consign his character to irretrievable disgrace and infamy.

Lieut. Bell is well known to many of the distinguished officers of the army and navy. He belongs to a profession which tolerates no dishonourable conduct in any of its members; and those who know him, believe him to be utterly incapable of the baseness with which he is charged before the public, in the Journal. He is now absent, at a remote station, where he may not, for a long time, meet with these foul aspersions on his character. It is, therefore, the duty of a friend, to whom all the material facts of the case are known, to lay a brief statement of them before the readers of the Journal.

Lieut. Bell applied to Mr. Shaw, as a manufacturer of percussion primers, to procure a number of these articles made according to a particular pattern, but which he did not obtain. This occasion was certainly the *first*, and, it is believed, the *only one*, on which Lieut. Bell ever saw Mr. Shaw. The interview occurred on the 18th day of April, 1829. This date is stated on the written authority of Mr. Shaw himself, recorded on that day.

The instrument for which Lieut. Bell has obtained a patent, was made and applied in the manner described in his specification, on, or before, the 13th of October, 1828, more than seven months prior to the interview with Mr. Shaw. The merits of the instrument were successfully demonstrated on that day; and the trial of it was continued on subsequent days, for several weeks, and until it had fired a cannon one thousand times, when the instrument remained in good order for further service. These facts are recorded in official documents, which were received and placed among the public records of the war department, in November, 1828. And the same facts were made known to Mr. Shaw, at the interview which he has undertaken to describe; the very time at which, as he now asserts, he imparted to Lieut. Bell the information which enabled him to construct the instrument; but which, as is now proved, had been made and tried a thousand times, more than half a year before. It is left with Mr. Shaw to reconcile these dates and facts, with the assertions and insinuations which are contained in the article to which his name is affixed in the Journal.

It is also alleged in the article referred to, that the instrument for which Lieut. Bell has obtained a patent, "is not in any essential particular, different from one patented on the 24th of October, 1828," by Mr. Shaw. Few persons would be able to discover the points of resemblance between them, or to point out the parts which are common to both, either in form or arrangement. But without undertaking to describe either, it is proper to point out *one* particular in which they differ; and which any other person than the author of the article quoted, would be apt to regard as *material* at least, if not essential. It is this: when the instruments are applied to fulfil the purposes for which both are alike designed, the one never fails, the other never succeeds.

Three of Lieut. Bell's locks, have been applied to different kinds of cannon, embracing the largest and the smallest used in the military service. They have fired these cannon about two thousand times, and many hundred times in succession, without a single failure, leaving all the locks in perfect order for continued service. These facts are recorded in official documents.

Of Mr. Shaw's locks some hundreds have been made for the public service. To what extent they may have been tried, may not be accurately known to the writer. But in all the trials which have been made, and officially recorded, it does not appear that any one of them ever made more than *four* fires, without being destroyed. The repeated failures of these locks, have, as is well known to the patentee, destroyed all confidence in them on the part of the experienced officers of the public service. It would be difficult to find any one who has witnessed the trials, who would permit one of them to be put on a gun, with which he was about to face an enemy. And it may be inferred that the patentee has himself abandoned them, as he has, very recently, presented a very different contrivance for effecting the same purpose.

It would appear that Mr. Shaw claims the merit of discovering the *principles* of the application of the percussion locks and primers, to the firing of cannon. It is a matter of official record, that this principle was communicated to him by another, more than eight years ago.

The writer is aware, that topics of this nature can possess very little interest in the estimation of the readers of the Journal. But as its pages have been made the medium of a wanton assault upon the character of an honourable man who is absent, it is but an act of justice to an injured individual, that these remarks should appear in the same journal, and it is on this ground that their insertion is solicited.

As the writer has no ambition to parade his name before the public, in matters of this sort, he does not annex it. It is, however, at the service of any one who may feel aggrieved by what he has stated. JUSTICE.

Washington, April 26, 1831.

FRANKLIN INSTITUTE.

Quarterly Meeting.

THE twenty-ninth Quarterly Meeting of the Institute was held at their Hall, on Thursday, April 21st, 1831.

THOMAS FLETCHER, Vice President, presided, and

Mr. ALEXANDER FERGUSON was appointed Rec. Sec'ry, *pro tem.*

The minutes of the last quarterly meeting were read and approved.

The quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on publications, with instructions to publish such parts as they may deem expedient.

The quarterly report of the Treasurer was read and accepted.

(Extract from minutes.)

THOS. FLETCHER, *Vice President.*

ALEXR. FERGUSON, *Recording Secretary, pro tem.*

Twenty-ninth Quarterly Report of the Board of Managers of the Franklin Institute, to the Institute.

THE Board of Managers entrusted with the administration of the affairs of the Franklin Institute, for the year 1831, in compliance with the salutary custom established by their predecessors, present the following report of their proceedings in the first quarter of their term of service. The cardinal interests of the society have been, as usual, placed in the charge of standing committees, and those objects which were deemed sufficiently important to merit the attention of the Institute, have been continued under the care of the select committees appointed by the former Board. The courses of instruction in Chemistry, Natural Philosophy, Mechanics, and Drawing, for the session of 1830 and 31, have been completed, and the Board have great satisfaction in announcing, that this department continues to receive from the members a cordial and gratifying support. The attendance of a class of 60 pupils upon the instructions of the teachers of drawing, and the orderly and correct deportment of the students, confirm the Board in their high opinion of the merits of the instructers in this important branch of education for practical mechanics, and warrant them in the indulgence of pleasing anticipations of the increased skill and ability which the rising generation of workmen will display in the production of those objects, which contribute to the wealth, the independence, and the comfort of the community. The regular lectures on chemistry, and natural philosophy, and mechanics, have been attended by numerous and highly respectable classes of both sexes, and the deep attention with which the demonstrations of the professors have been received, furnishes conclusive testimony in favour of the continuance and extension of this department. For this purpose, the committee of instruction now has under consideration, the expediency of establishing a professorship of practical mechanics, and we would especially call upon the members of the Institute not to suffer a proposition, fraught with such manifest advantage, to be postponed or abandoned for the want of pecuniary means to carry it into operation.

We are indebted to Mr. A. Miller, J. R. Leib, Esq. and Mr. A. Crease, for many valuable volunteer lectures, bearing upon the interests of useful knowledge and scientific acquirements, for which the warm acknowledgments of the Board of Managers have been presented to those gentlemen. The high character which the practical men of Philadelphia have for skill in their professions and general intelligence, should operate to bring them before the public in the character of lecturers; and the importance of correct views to the young mechanic, will, we trust, call into the field, in the session of 1831–32, a numerous corps of practical volunteers, who, despising the profit of retaining in secret the experience which they possess, will render it of double value by sharing it with the public.

The Board, deeply impressed with the benefits which have hitherto attended the exhibition of American manufactures, held under the auspices of the Institute, directed the early attention of the committee on premiums and exhibitions to that subject, and in conformity with their favourable report of the expediency of holding one in the fall of the present year, have caused an address to the manufacturers of the United States, with a list of premiums, to be published, and the committee are now actively engaged in the necessary preliminary operations which are requisite to a successful completion of the wishes of the Board. It is hoped that a very early appointment of the committee of arrangement, and the exertions of competent agents in the large manufacturing districts of the Union, will insure, at the next exhibition to be held by the Institute, an unrivalled display of our domestic products, and confirm the Board in the opinion, that honorary rewards offer a powerful stimulus to bring into operation the skill and ingenuity of our fellow-citizens. For this exhibition, the Board respectfully claim the cordial co-operation of the members of the Institute, in contributing to its embellishment, as well as in disseminating its plan in the extended circle of their acquaintance. The library and reading room continue in beneficial operation, and are regularly attended by a numerous portion of the members of the Institute. The importance of these departments demand considerable enlargement, but the limited pecuniary means at the disposal of the Board, prevents as large an appropriation to the committee on the library to improve and extend their usefulness, as is desired. Our main reliance for the gradual extension of these important auxiliaries, is in the known liberality of our fellow-citizens, from whom, donations to these objects are frequently placed at the disposal of the Board. The committee on minerals are now actively engaged in classifying and arranging, in a scientific manner, the collection of minerals now in our cabinet. They are aided in their labours by Mr. Jacob Pierce, whose valuable assistance in rendering this department useful, merits the highest eulogium. The Board have to regret that the professional engagements of their committee on models, have hitherto prevented their attention to the classification and arrangement of the models, now belonging to the Institute. We have reason to believe that the exertions of the members directed to the increase of the cabinet of models, would result in an enlarged and valuable collection of objects, teeming with instruction to our mechanics, and tending to prevent, in a great degree, the lavish expenditures of money, time, and industry, in the formation of machines which have already been successfully put in operation by the ingenious men of our country.

The committee charged with investigating the value of water as a moving power, have brought the experiments connected with the main question to a conclusion, and a part of their valuable report will appear in the March number of the Journal, which is now on the eve of publication. A course of experiments on adjutages has been commenced under the auspices of the same committee, and is now almost completed—the public will be put in possession of the result as soon as practicable. To the gentlemen composing this committee, the thanks of the community are justly due; and the Board appeal with confidence to the members of the Institute and the public, to relieve the committee from the pecuniary responsibility under which they rest, for the payment of the excess of their expenditures above the amount received in subscriptions. The experiments on the causes of explosion in the boilers of steam engines, and the means which may tend to prevent so frequent an occurrence of these evils, are now progressing, and much valuable information has been placed in the hands of the committee. The apparatus intended for direct proof of the theories upon these subjects, is in a state of forwardness which will insure the publication of the results from actual trial, immediately after the report of the committee on water power has been printed. The Board have to announce the loss of the valuable services of Messrs. Thomas Loud and John Wiegand, as managers of the Institute; the vacancies have been filled by the election of Messrs. George Fox and George W. Tryon. In concluding this report, the Board cannot refrain from expressing the high gratification which they feel in the present flourishing condition of the Institute, and the only regret which mingles with this feeling, is caused by the limited participation of the mechanics and manufacturers of our city, in an institution which offers to their acceptance the riches of science in all its varied departments, at a yearly cost far below the weekly expenditures of many on mere sensual gratifications. We call upon them by that consideration which usually brings into action all the best energies of man, his own interest, to come forward and enrol themselves as members of the Franklin Institute, and as ardent, efficient, and free fellow labourers in the field which is cultivated by this institution, to exhibit to the world that our complete independence is caused as much by the beneficial communication of mutual knowledge, as by the freedom of our civil constitutions.

SAML. J. ROBBINS, *Chairman, P. T.*

WM. HAMILTON, *Actuary.*

Monthly Meeting.

THE stated monthly meeting of the Institute was held at their Hall, on Thursday evening, April 27th, 1831.

Mr. C. C. HAVEN, was appointed chairman, P. T.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Chs. Babbage, Esq., of London.

Reflections on the Decline of Science in England, and on some of its causes.

An Address to the Labourers, on the subject of Destroying Machinery.

By John Gilmore, Esq.

Congressional Directory for the Second Session.

By the Newark Mechanics' Association.

An Address delivered before the Association, by Professor John Griscom.

By Jas. J. Barclay, Esq.

First and Second Annual Reports of the Inspectors of the Eastern Penitentiary of Pennsylvania.

Remarks on the Expediency of Abolishing the Punishment of Death.

By Jas. R. Leib, Esq.

A Lecture on Scientific Education, delivered before the Institute.

By Geo. W. Smith, Esq.

Arguments in favour of the proposed Canal round the Western Abutment of the Schuylkill Permanent Bridge.

By R. C. Winship.

Ouvres Diverses, 1685.
Fourteen Numbers Casket.
Twenty do. Ariel.
Fifty do. Souvenir.

By Messrs. Carey & Lea.

Reports on Locomotive and Fixed Engines; with an account of the Liverpool and Manchester Railway.

By Mr. James Ronaldson.

Seybert's Statistical Annals of the United States.

Memoirs of the Life and Writings of B. Franklin, 6 *vols.*

An Account of the Louisville City School, with the Ordinances of the City Councils, and the Regulations of the Board of Trustees for the Government of the Institution.

Thirteenth Annual Report of the Controllers of the Public Schools for the First School District of the State of Pennsylvania, with their Accounts.

By Professor A. D. Bache.

Sur les Machines á vapeur et sur les Explosions des Machines, á vapeur, par M. Arago.

By Professor Franklin Bache.

Report of Moncure Robinson, Esq. and Col. S. H. Long, Engineers, appointed by the Canal Commissioners for examining the different Routes for Crossing the Alleghany Mountains; Read in Senate, 14*th March,* 1831.

An Introductory Lecture on Political Economy, delivered at Nassau Hall, Jan. 31, 1831, *by Professor Vethake.*

Third Report of the Oneida Institute of Science and Industry.

By Provost Wm. H. De Lancey, D. D.

A Charge addressed to the Graduates in Medicine, of the Uni-

versity of Pennsylvania, by himself, at the Public Commencement, held March 24, 1831.

By Professor W. R. Johnson.

A Lecture on the Importance of Linear Drawing, and on the Method of Teaching the Art.

Some Observations on the Electrical Characters of Caoutchouc.

By Col. S. H. Long.

Report to the Canal Commissioners in Reply to Strictures, passed by Mr. Robinson, on the Views entertained by Lieut. Col. Long in relation to the Manner of Crossing the Alleghany Mountains by means of a Rail-Road.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

London Journal of Arts and Sciences, for January, February, and March.

The Mechanics' Magazine, for December, January, and February.

The Repertory of Patent Inventions, for January, February and March.

The Register of Arts and Journal of Patent Inventions, for January, February and March.

The Journal of the Royal Institution of Great Britain, for February.

Recueil Industriel, for June and September.

Bibliothéque Physico-economique, for November and December.

Annales de Chimie et de Physique, for August and September.

Journal Universel des Sciences Médicales, No. 175.

Journal Universel et Hebdomedaire de Medecine et de' Chirurgie, *Vol.* 1. *No.* 1 *to* 12.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for September.

Annales de l'Industrie Francaise et estranger, for June, July and August.

North American Review, for April.

American Annals of Education, for March and April.

Journal of the Philadelphia College of Pharmacy, for April.

Magazine of Useful and Entertaining Knowledge, for February.

The American Quarterly Review, for March.

The Ladies' Book, for March and April.

The American Journal of Arts and Sciences, for January.

The subject appointed as the topic of discussion for this evening being called up, some remarks were made; after which it was continued as the subject for the next meeting, and the following was also appointed for the same evening, viz.

What are the best means of securing the boilers, cylinders, and all other parts of steam engines, whether employed for stationary purposes, for navigation, or for locomotive carriages, against loss of heat by radiation and conduction?

C. C. Haven, *Chairman.*

J. H. Bulkley, *Recording Secretary.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JANUARY, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a mode of *Saving Water in Water Power;* Aaron Foot, Williamstown, Berkshire county, Massachusetts, January 4.

The patentee tells us that he claims the "applying to useful purposes, that momentum which water retains after passing from the principal, or common water wheel."

This it is proposed to do by applying a second water wheel, to be operated on by this *waste* water. The two wheels are to be geared together, by the intervention of cog wheels. The secondary wheel is to run more slowly than the principal, in the supposed proportion of the power of the two.

We recollect a similar project having been patented two or three years ago; and some of the water wheels which are in use, certainly appear as though they might be aided by such an appendage; we, however, are decidedly of opinion that in all well constructed wheels, it would be a waste of power to attempt to gain any from the waste water; and no one will commend the plan of constructing a main wheel badly, for the sake of applying a secondary.

If there is more *momentum* in the water, after it leaves the wheel, than is necessary to carry itself off, the structure is bad; and if there is not, the secondary wheel may do much harm, but cannot be productive of any good.

---

2. For a *Vertical Tooth Extractor;* Ira W. Rutherford, Albany, Albany county, New York, January 4.

Numerous vertical extractors have been made, and every dentist of any eminence has tried them. There are cases in which they may be used with advantage, but so far as our information goes, those who have possessed the best instruments of the kind, have rarely employed them. In by far the greatest number of instances, a well constructed key, skilfully used, is the best. The extractor now proposed is ingeniously contrived, but although it differs in the construction of some of its parts from others made with the same intention, its general operation is the same. The tooth is to be embraced between claws, which are wedged together by forcing a piece between their upper ends by means of a thumb screw, on the main shaft of the instrument. A piece of India rubber, of soft wood, or of some other suitable substance, rests upon a sound tooth, or teeth, to operate as a fulcrum.

The patentee says, that "the advantages which it has over a newly mounted instrument, is, that it combines the lateral motion with the perpendicular." We do not know to what newly mounted instrument he alludes, but, whatever the individual may be, there are more than a dozen others variously constructed, and the question, of superiority, therefore, does not lie between it and one other instrument only, but between it and a number of competitors.

3. For an improvement in the *mode of adjusting metallic plates to artificial teeth;* Thos. R. Vanderslice, city of Philadelphia, January 5.

Instead of applying a metallic plate on the back part of the artificial tooth, in the usual manner, the tooth is to be moulded with a groove in the back part of it, into which the metallic plate will fit, and where it is to be secured by riveting or soldering to platina wires laid in their proper places in the groove at the time of forming the tooth.

There is to be a strip of bone, ivory, or other hard substance used to form the groove in moulding the tooth, and this is to be drilled to receive the wires. Neither this, or the manner of forming the groove, is represented by drawings, which certainly might have been done. We have repeatedly quoted the words of the patent law relating to this point, "and *shall* accompany the whole with drawings and written references, whenever the nature of the case *admits* of drawings."

4. For a *Furnace for generating Steam for Culinary Purposes;* Jesse Reed, Marshfield, Plymouth county, Massachusetts, January 5.

This furnace may be made of cast iron. It is to consist of two vertical, cylindrical vessels, one placed within the other, a space being left between their sides to contain water. The inner vessel is to form the fire place, the bottom of it is formed of bars, and upon them the fuel is to be placed, and is consequently surrounded by the double cylinders which contain the water. A close cover forms a steam tight connexion between these cylinders, and has in it perforations for steam pipes to lead into other vessels, and for a safety valve. Above the fire, there is a grate to sustain a kettle, or other vessel, in the manner of the common clay furnaces.

"The improvement in my said steamer, which I claim as new, consists of such additions of surrounding parts to the common clay or soap stone furnace now in use, as will enable me to arrest the portion of heat which in ordinary use, escapes through the side of the furnace, and with it to boil the water which generates the steam for the purpose before mentioned."

All this may be very intelligible to some folks, but such is not the case with us. We are at a loss to discover in what way the heat which escapes through a clay, or soap stone, furnace, is to be saved, where neither of the materials are employed; and furthermore, we apprehend, putting both clay and soap stone out of the question, that this contrivance will not be found either very convenient or useful.

5. For an improvement in *Thrashing Machines* for thrashing all kinds of chaff grain; Isaac Norton, Saratoga, Saratoga county, New York, January 6.

The beaters are to be placed upon four arms instead of upon a cylinder. The feeding apron is to be of slats of wood, the teeth are to be square and tapering, and from three-fourths to two inches long. There is to be a hollow segment supported by springs, and means are to be adopted for giving motion to the moving parts. There is no claim to novelty; the beaters, the wooden apron, the teeth, the segment, &c. being all very old, we, therefore, greet and dismiss them with all the veneration which their antiquity inspires.

---

6. For an improvement in the *manufacturing of Ropes;* Edward S. Townsend and Philo Durfee, Palmyra, Wayne county, New York, January 6.

(See specification.)

---

7. For a *Machine for taking out stumps from land;* Abijah Gorham, Turner, Oxford county, Maine, January 7.

A wheel and axle is mounted so as to be drawn about upon truck wheels. From the middle of the axle a chain descends, which is to be fastened to the stump. Oxen are to draw upon another chain passing round the wheel, and thus the stumps are to be raised. We are not informed whether this machine is claimed wholly, or in part only; this would indicate that the patentee considers it as altogether new; but, according to information *derived from other* sources, we arrive at a very different conclusion.

---

8. For *Blocks, on which Stereotype Plates can be imposed,* denominated "Stereotype Extendible Blocks;" George W. Grater, city of New York, January 7. (Assigned to Elihu White, New York.)

Instead of the separate blocks usually employed, strips of mahohogany, reduced to a proper width and thickness, are to be locked up in a common printer's chase. The same strips, under a different arrangement, serve for folio, quarto, octavo, 12mo. or 18mo. pages. Six of the strips are to be about three inches wide, and six to be about three-quarters of an inch. Upon these latter are the proper hooks, or clasps, for retaining the plates. The particular construction of these strips and clasps are shown in drawings which accompany the specification. The wider, are called major, and the narrower, minor blocks. The claims are, to the particular plan of fashioning and arranging the blocks, so as to produce the effect intended. The using of fixed hooks attached to blocks, for the purpose explained in the specification: and the combination of the whole, in the manner set forth.

---

9. For a Machine for *smoothing the bodies of Printing Type.* Invented by Stephen Sturdevant, of the city of New York; assigned to Elihu White, of the same city, and patent issued to him, January 7.

"In place of the usual mode of smoothing the type by rubbing them under the fingers, on the flat surface of a grit-stone, I produce the same effect on them, by causing them to pass between two rotary blocks of metal, faced with steel, and having floats cut in the steel faces, to scrape the type as they pass through."

The specification refers throughout to drawings which represent the machinery in a very distinct manner, and occupy considerable space. Without a view of the machinery, the claims could not be understood; they, however, are very clearly made out.

10. For a *Machine for casting Type,* invented by Michael D. Mann and Stephen Sturdevant, both of the city of New York; assigned to Elihu White, of the same city, and patent issued to him, January 7.

The remarks on the last patent apply with full force to the present. Judging from the drawings and description, the machine appears to have been devised with much skill; and every part of it is represented with great neatness and precision.

11. For an improvement in *Frames for Cotton Gins;* Ebenezer A. Lester, Boston, Massachusetts, January 8.

This patent is taken for making the frames of cotton gins, in whole or in part, of cast iron. The claim is to the "making of the two ends of the frame of cast iron, whether the said ends be connected together by girders and sills of wood or metal."

12. For an improvement in the *construction of Boats,* whether propelled by steam or other power; Nathan Cushman and Isaac Loomis, Whitehall, Washington county, New York, January 8.

A channel is to be made in the boat from stem to stern, to allow a free passage to the water; and in this channel the paddle wheel is to work. There is to be an inclined plane running from the bow of the boat, back to the wheel, and crossing the channel in which the wheel runs. This is to form a flume, up which the water is to rise, and from which it is to act upon the wheel. Such appears to be the intention, so far as we can understand the description. But as reference is made, throughout, to a model, and this part is not represented in the drawing, we are left to guess upon this point. It is altogether irregular to make any such reference, to a model; and to depend upon it, as in the present instance, would be likely to avoid the patent, as of this a model makes no part. The drawing is imperfect and inadequate, not exhibiting the parts described, or having any written references. There is no claim; and it is manifest that the patentee does not depend upon the inclined plane, as he tells us that the boat may be used either with or without it; all that is then left, to rest the patent upon, is the channel along the middle of the boat, which is a well known contrivance, having been long, and repeatedly used.

13. For an improved *Portable Grist Mill;* Henry Weed, Sandwich, Stafford county, New Hampshire, January 10.

The stones are proposed to be much larger than in most of the portable mills recently patented; say thirty inches in diameter. A frame is to be made to support the stones, at the lower part of which frame there is to be a bridge tree, which is to be raised by a screw. The lower mill-stone is to be fastened on a spindle, and the upper is to be fixed upon the frame, with ears, screws, and nuts, to adjust it. Through the top stone there is an eye, as usual, for the feed. An iron bar crosses this stone over the middle of the eye, and receives the upper end of the spindle. The bar has springs to it to allow it a little play.

The claim is to the above arrangement, with the nether mill-stone running instead of the upper; the mode of adjusting the upper stone; the supplying the weight of stone by the bridge tree, and the bar and spring to sustain the upper end of the spindle.

Without inquiring into the originality of the other parts, we may observe that the running of the lower mill-stone has been more than once patented, and that the claim to this, therefore, must fail entirely.

---

14. For an *improvement in Distilling;* John Cairou, city of New York, January 10.

This apparatus is intended to produce highly rectified spirit at one operation. The vapour, as it rises from the still, passes through successive receivers, like kettles placed upon each other. The portion which is condensed in each dropping through a tube back into the vessel below it. After escaping from these, the vapour passes through a horizontal worm; each coil of this worm has a tube leading down from its lower part, into a common tube, to conduct that portion of the spirit off, which is less highly rectified than that which passes through the worm; this latter is finally condensed in the usual way. The parts intended to be claimed appear to be those which allow of the escape of the less pure spirit in its progress towards the final condensing tub.

This patent refers, throughout, to a model; a fault into which patentees, for want of better information, are very apt to fall. We have noticed this in No. 12.

---

15. For a Machine for *edging and drawing Steel Points for Carriage Springs;* George Stoudinger, Newark, Essex county, New Jersey, January 11.

A female die is to be formed, consisting of a steel roller, running as a flatting mill roller, and hollowed out in such a way as to suit the point to be drawn. Below this roller is a bed, which advances upon a carriage, as the roller turns. The platform of this bed has an inclination given to it, which is regulated by means of screws, in order to adjust it to the degree of taper to be given to the point. There is no claim; but as we believe the mode of drawing the points by means of the inclined plane, to be new, the machine itself may, in that case, be considered as altogether so, this being its essential feature. The plan proposed appears to be not only more easy of execution, but much preferable in practice to the use of eccentric rollers.

---

16. For a *Thrashing Machine;* Samuel Turner, Aurelius, Cayuga county, New York, January 11.

This machine has a cylinder, and bed, with teeth, in the usual way. The teeth are to be of wrought iron, and are to stand out about two inches. They are to be tapering, being about three-quarters of an inch wide at bottom, and one-quarter at top, placed in such a manner as to escape those in the bed, and leave proper space between them as they pass. The claim is to the formation and structure of the spikes, or teeth; their position in the bed and cylinder, and the lining of the bed with band irons.

---

17. For a Machine for *Thrashing Grain, and Dressing Flax and Hemp;* Stephen J. Gold, Cornwall, Litchfield county, Connecticut, January 11.

In this machine there are several pairs of beaters, or tumblers, between which the grain, or hemp, is to pass successively. Whirls of different sizes are used to drive them, and they are thus caused to move with different velocities. The claim is to "several pairs of beaters or tumblers in the machine, one pair moving faster than another; and the combination, viz. the grain, hemp, and flax machine."

---

18. For an improvement in the common *Tin Baker;* Gordin Williston, New London county, Connecticut, January 11.

This baker is to stand before the fire, and is in fact what is commonly called a tin kitchen. The lower part is to be made to reflect heat upwards, as the upper part does downwards.

"What I claim as new, and as my invention, and nothing else, is simply the substitution of the reflecting surface in the lower part of the pan, instead of the box for coal as in the baker in common use. Making thus the 'Double Reflecting Baker.'"

We do not understand the description given, and cannot, therefore, point out the merits of this invention.

---

19. For an improvement in the *Mode of Curing Tobacco;* Tyre G. Newbold, Franklin county, Virginia, January 11.

The improvement proposed is, "after having a tight house in which the new cut tobacco is to be hung, build a furnace at a convenient distance from the walls of said house, and have a funnel extending on the ground from said furnace through the house, and turning back discharge the flame and smoke in the open air, at a convenient distance from the building. The furnace and funnel to be made of brick, stône, or other incombustible material." This comprises the main point of the specification, and we much mistake if the claim of the patentee, to be the true and original inventor or discoverer, will prove to be an undisputed one.

There is no drawing of the furnace and funnel; objects which certainly might be drawn, and a representation of which would undoubtedly aid those who wish to carry the plan into operation.

20. For an improved mode of making *Harrows for the purpose of Agriculture*, called the "Revolving Harrow;" Samuel Rugg, Lancaster, Worcester county, Massachusetts, January 11. (See specification.)

21. For the *Application of Water to Mill Wheels;* which the inventor calls "the Syphon Principle, or Artificial Pressure;" William Kendall, Fairfield, Somerset county, Maine, January 12.

The specification of this patent is drawn up with great labour; it includes many numerical calculations, and an essay upon the application of water in mills of different kinds. From the course pursued it would be extremely difficult to give an analysis or epitome of this paper; we will, however, make one or two quotations, which may perhaps afford a general idea of the proposed plan. The wheel is a kind of tub wheel, with the buckets secured between two rims, with the shaft connected to one of them.

"The wheels which I have constructed and applied to my invention, have buckets, as it were, at right angles with the former wheels, and lie thus ╲╲╲╲. The water may seem to act upon it by pressure from the whole of the head, but it is only by reaction that the wheel moves. This wheel which I have constructed for ease in making, and permanency of its parts, may represent at a glancing view, that which was formerly called a tub wheel, except it has no arms, the buckets entering the shaft, and are supported in the rim; they are very flat, and very thin; their edges which cut and leave the water are made sharp. By their obliquity they scarp or lap over each other, and the space between them all is called the throat, or opening of the wheel; they decline about three or four inches to a foot of their width. For a wheel of four feet diameter, with seven buckets, their width becomes about fifteen inches at the shaft, and two feet at the rim. This rim then requires to be about ten and a half inches deep, so as to extend one inch below the buckets, and two inches above, for passing a feather edged bar of iron through with its thick edge resting against, and fair with, the buckets, as a cutter; one end being driven well into the shaft, the other end bent down and supported under a hoop, which binds the rim and wheel," &c.

The specification, of which we have copied a very minute part, thus concludes: "Thus have I endeavoured to explain the principles and how to use this invention, where an additional artificial pressure is applied to the wheel, increasing its effects by suction, which I call the syphon principle, where the force of the percussion of water, as well as gravity, is applied to repel the atmospheric pressure, which I claim as my invention when applied to mill wheels. Also the wheel and parts for applying the same according to this my specification."

We confess that we do not understand the reference to the atmospheric pressure, and the syphon principle, although we have carefully read the parts in which they are described; but the description is an involved one, and we could not take the time to make it a study, without a fair prospect of learning something from it. The drawing which accompanies the specification, lends little or no aid to the description, being very indifferently executed.

---

22. For an improvement in the *Manufacture of Buttons*, called the Safe Eye Button; Charles Goodyear, Philadelphia, Pennsylvania, January 12.

This patent is taken for enclosing pieces of cloth, leather, or other substances which can be penetrated by a needle, between plates of metal. These plates have a hole of one-quarter of an inch diameter punched in them, to serve as an eye through which the sewing is to be effected.

"The improvement which the said Charles Goodyear claims consists in the manner of fastening between the shells, the cloth, leather, catgut, or substance to be sewn through, and in making the eye of the button of cloth, leather, catgut, or other substance of a similar form, leaving holes, and thereby obviating the objection to most buttons which are liable to cut the thread with which they are fastened on clothes."

The specification describes the formation of the plates or shells, and the manner of uniting them; but these are not represented by drawings, which ought to have been done.

---

23. For an *Instrument for the Teaching of Geography;* Elizabeth Oram, city of New York, January 12.

As this instrument is the invention of a lady, we will, of course, allow her to tell her story in her own way, without any animadversions of ours, which might mar the narrative, or involve us in inextricable difficulties.

"Be it known, that I, Elizabeth Oram, of the city of New York, have invented a new and useful instrument for the teaching of geography, and that the following is a full and exact description of the construction and use thereof as invented by me.

"It consists of a globe, upon which the surface of the earth is represented by various heights, as they exist in nature. By this the distinction between land and water is clearly seen. The various ranges of mountains, with their relative heights exhibited; and their influence upon heat and productions, with their geological structure.

"By means of a magnet inserted in the surface of the improved globe, the great principle of attraction may be clearly shown, by affixing thereto any small iron figure.

"This globe is surrounded by the principal circles of the sphere, The ecliptic is elevated, by means of which, and a moveable and illuminated sun, the manner in which the earth receives its rays, and the causes of seasons, may be clearly exhibited. On the horizon there is affixed a small instrument, by which the causes of eclipses are shown.

"A moveable star, brings to the comprehension of pupils the nature of right ascension, declination, celestial latitude and longitude."

ELIZABETH ORAM.

---

24. For an improvement on the *Bar Share Plough;* Edmund M. Waggenet, Adair county, Kentucky, January 12.

We have no doubt that the plough described is a very good one, but its appearance is much like that of many other ploughs; and although the patentee has placed it before us with much care, he has not told us in what his invention consists; he has, however, mentioned some of its good properties, and we will repeat after him, that "The plough is adapted to work with or without a coulter, and designed for fallowing, ridging, and ditching farm lands; draining marshes; turnpiking roads, and repairing highways."

"The projective slope of the bar and share gives to the plough a descending draft, which causes it to draw to and retain its hold in the earth to the depth regulated or required. The rolling board and face of the share forming a regular circle, and passing on at near right angles, *rolls*, *beds*, and *pulverizes* the earth at one and the same time. Placing the surface soil to the depth the plough runs, and bringing the clay, or sub-soil, upon the surface. All parts of the plough which are pressed by the earth being metallic, immediately scours smooth, cuts, slides, and rolls off the earth without friction or compression, which renders the draft extremely light; and from the combination of its parts, is rendered the more permanent by a hard draft."

---

25. For an improvement in the *Percussion Lock for Cannon;* Enoch Hidden, city of New York, January 14.

In its general features this lock bears a strong resemblance to that patented by Mr. Joshua Shaw, of Philadelphia; but to lessen the powerful reaction upon the cock, or hammer, from the explosion, by which it is liable to be broken, that part of it which is immediately over the vent, has a hole drilled in it, to allow the explosion from the touch hole to pass through it. It has also a preventive spring, placed near the head of the cock, to ease it off in its recoil.

The claims are, the opening in the head of the cock; the mode of making the cock, as described in the specification; the preventive spring; a small steel or other metal tube to contract the vent hole; a piece of metal with leather or sponge, to place on the priming to keep it dry, or to close the vent when the gun is sponged, &c.

---

26. For sawing boards by means of a *Double Toothed Saw;* Stafford Dawly, Annsville, Oneida county, New York, January 14.

At p. 10, (No. 70 in the list,) we gave a description of a saw with double teeth to saw timber by the moving of the carriage in either direction.

The present patent is obtained for the same thing precisely, and furnishes an example of what is perpetually occurring at the patent office. There is scarcely an instance in which any thing is patented which has the slightest air of novelty, that several do not claim to be the original and true inventors. We are aware that priority in the date of a patent is no evidence whatever of priority of invention. The real inventor is in general anxious to test the goodness of his plan, and whilst doing so, some of the numerous patent pirates with which many parts of our country are infested, catch the idea, and to those in this trade, an oath presents no obstacle to the attainment of their ends.

We know nothing about who is the inventor of the double saw; perhaps he has not yet come forward, and therefore our remarks are not at all individual in their character. Nor are they now made in consequence of the intrinsic merit of the present plan, as we think lightly of it on several accounts. The timber must be sawed entirely off at every cut, which in many instances cannot be done. The carriage has its bearing changed when its motion is reversed, and the boards will, in consequence, be sawed with less truth; and the teeth at each edge of the saw must be set equally open, and those which are not cutting will injure the face of the timber.

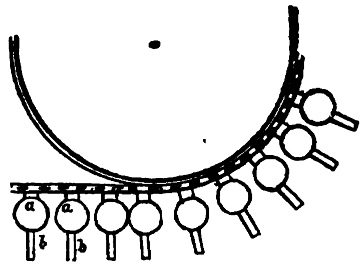
Three or four unmeaning lines constitute all that can be called a drawing in this patent; the object it is true can be well understood without a drawing, but the law claims one, and admits of no discretion on the subject.

---

27. For improvements in *Navigation, and in the application of Steam, Men, Animals, or other Natural Agents, thereto;* William W. Van Loan, city of New York, January 15.

The essential feature of this plan is the passing of an endless chain of paddles over drums, in order to operate upon the water, in place of the ordinary paddle wheel. In this, taken simply, there is nothing new; but there are some particulars in which the plan proposed lays claim to originality.

The drums over which the endless chain passes are to be air tight, hollow cylinders, and each of the paddles, or keels, as they are called in the specification, is attached to a buoyant, hollow, water-tight vessel, running its whole length. In the accompanying sketch, the ends of the chain of paddles are shown passing round one of the drums, *a*, *a*, being the air-tight vessels, and *b*, *b*, the keels, or paddles.



The patentee says that, "in order to the more clear and full understanding of my invention, I further declare and set forth, that it rests upon the following principles."

"1st. In substituting for the paddle wheels, or other usual propelling apparatus, an endless chain of empty water-tight vessels, made to revolve upon appropriate drums or wheels, by steam, or any other prime mover whatever."

"2nd. In substituting for the buoyancy of the hull of a boat, or ship, the buoyancy of the immersed part of the endless chain of vessels, or when necessary, of hollow drums, or cylinders, or prisms, and the carrying forward any load they may bear, free from any resistance but that which they themselves experience. By these means getting wholly rid of the rapidly increasing resistance that fluids present to motion through them. I retain only a resistance whose measure is independent of velocity, and have thus in my power, theoretically, to obtain unlimited velocities: and, in practice, velocities limited only by the power of the prime mover that may be applied to the apparatus."

It is proposed to apply the same principle of buoyancy to the paddle wheels of team and steamboats, as an additional security against their foundering.

The whole description is written with much judgment and talent, but from what we know, and have seen, of attempts to propel vessels by endless chains of paddles, we anticipate no advantage from this part of the plan, when the test of practice is applied to it.

---

28. For an improvement in the manufacture of *Saddles;* Levi Sherman, Bridgeport, Fairfield county, Connecticut, January 18.

In this saddle, nailing is substituted for sewing. The straining of the web, &c. is effected in the usual manner. The seat is drawn over and nailed fast. The skirts are nailed to the side bars.

Sometimes the skirts, or jockey, are made to meet in the centre of the saddle, and are seamed or stitched together; then stitched or seamed from one side bar to the other, and the skirts nailed on the side bars around the bellies of the saddle. The claim is to "the mode of making saddles by nailing instead of sewing the seams."

---

29. For an improvement in the *Reaction Wheel;* John Turner, Augusta, Kennebeck county, Maine, January 18.

This patent is taken for an arrangement which is essentially the same with that claimed by Calvin Wing, the specification of whose patent was given in our February number, page 86. In the present specification the whole is imperfectly described; the part which Mr. Wing calls the *lighter* is here mentioned, and we are told that "this mode of relieving the wheel from the weight of the incumbent column of water, is what is specifically claimed as my invention."

---

30. For *Stiffening Wool and Fur Hats and Caps* by the

use of India rubber, &c.; Laban L. Macomber, Gardiner, Kennebeck county, Maine, January 19.

(See specification.)

31. Machine for *Planting Onion Seed, all kinds of Garden Seed, Beans, Corn, &c.;* Peter Smith, of Chatham, and Theodore H. Arnold, of Haddam, Middlesex county, Connecticut, January 20.

This machine is to be driven forward like a wheelbarrow; it has two wheels united by a cylindrical shaft. Above this shaft two hoppers are placed to contain the seed; the cylindrical shaft fits against and closes the lower part of the hoppers; holes are bored in the shaft to form chambers, or receptacles for the seed, and they are to be larger or smaller according to the kind of seed to be sown. The hoppers may be more or less numerous; and the cylinder also may be varied. The claim is to "the arrangement and putting together of the various parts in the way and manner described, and the application of said machine in the form and method above described for the purpose of planting seeds."

32. For a mode of *applying the propelling power of water, steam, or any other known power, to mills or machinery;* Jehiel W. Dart, and Willard Webster, Truxton, Courtland county, New York, January 21.

The patent under the above title, is for one of those futile and worthless contrivances which are by no means rare in the records of patented inventions. That others may judge on this point as well as ourselves, we give the whole specification.

"Make a water wheel of a smaller diameter than the fly or balance wheel to be hereafter described. On the same shaft place a drum, pulley, or cog wheel, of the same diameter as the wheel first mentioned, or it may be larger or smaller. Make another wheel of a larger diameter than those before mentioned; and let it be connected by straps, belts, or cogs, to the last mentioned wheel. Let the gearing intended to be applied to mills or machinery work in this last mentioned large wheel, or into another wheel placed on the same shaft with it, and of the same size; or it may be larger or smaller as may be deemed most proper.

"The *invention* here claimed, and desired to be secured by letters patent, is the arrangement of the wheels as above described, by which the power originally applied to a small wheel, is communicated to mills or machinery by the intervention of another wheel or pulley, giving motion to a larger wheel."

JEHIEL W. DORT,
WILLARD WEBSTER.

Comment is entirely out of the question.

33. For a *Furnace for Heating Tyre;* Dudley Marvin, Canandaigua, Ontario county, New York, January 21.

The furnace is constructed in the form of a circular trough, usually of cast iron, formed in segments, the inner rim of the trough is small enough to admit the tire of the fore wheel of a carriage, and the outer rim sufficiently large for the hind wheel; a hollow channel passes round under the furnace; the plate which forms the top of this channel and the bottom of the furnace, is perforated with many holes, to allow wind to pass up from the channel. A large pair of bellows supplies this channel with air; charcoal is put into the circular cavity and ignited, and the tire placed upon it. The whole hoop is thus equally and rapidly brought to a red heat. Three minutes has served for this purpose, after the furnace had become heated. The parts are well adapted to the end proposed, and in large establishments we have no doubt that it will be found eminently useful.

---

34. For *Propelling Machinery;* Thomas D. Newsom, Nashville, Davidson county, Tennessee, January 22.

Although this specification is writen in English, it might, for our use, as well have been offered to our comprehension in the language of Psalmanazer. On looking at the drawings, we perceived that the intention was to propel machinery by the vibration of a pendulum; the array of levers, wheels, and pinions, however, was too formidable to admit of our seeing through the design of the patentee, without resorting to his description, but after reading this, the darkness was only rendered the more visible. We could only discover that there was to be a double rimmed draft wheel; a double winged lever; a swing lever with a circled fork; two cranks on one shaft, and one somewhere else; two pitmen; a draft wheel; a drum wheel; a chain to work round two pulleys; two lever wheels; two speed cog wheels; a pulling wheel; two purchase levers; a gearing cog wheel; a fly wheel; a scape circle; and a number of other unmentioned and unmentionable parts, all of which are in some way, we do not know how, to be animated by means of a swinging weight, or pendulum, and is then to propel *steamboats*, rail-way carriages, and all kinds of machinery. In order to do this "there must be a seat on the end of the swinging lever, on which a man places himself, having a spring attached to the end of the carriage for the rider to place his feet against, to keep up the vibrating of the lever, propelling forward the vehicle."

---

35. For an improved *Knife for Cutting Tobacco;* James J. Mapes, city of New York, January 22.

The claim is as follows.

"The invention here claimed, and desired to be secured by letters patent, is the above described case or stock, with the moveable steel blade, which can be renewed when worn, from time to time; the case remaining the same; whereas in the common method the knife is made all of one piece, and when the steel is worn the whole knife must be thrown aside."

The contrivance is something like that of a double ironed plane, that is, the cutting knives of tobacco machines are to be made to set forward by means of screws tightening them upon slats.

---

36. For a machine called the *Self-regulating Conduit*, for passing water around canal locks, from a higher to a lower level; James Clark, Westmoreland county, Pennsylvania, January 25.

(See specification.)

---

37. For a *Bevel Wheel Plane, for Planing Boards, &c.*; Jonathan Newhall, Washington, Lincoln county, Maine, January 25.

Plane irons are fitted into the rim of a wheel, so as to cut on one face of it. Four, six, or any other number of irons may be used. The shaft of the wheel is to run in collars behind the cutting side, so as to leave the face unobstructed. The shaft has a sliding motion in the collars, to adapt it to stuff of different thicknesses. The wheel may be three feet in diameter, and its face is to be bevelled, so as to take off about half an inch on the edge, and to extend to two inches, or upwards, upon the face, according, as we suppose, to the width of the irons. The mouths of the planes may be made more or less open by means of plates of iron let in flush, but capable of sliding, so as to close the mouth when desired. These, of course, are to be tightened by suitable screws.

The timber is fixed upon a suitable carriage, and is to be moved along by a rack and pinion, or otherwise.

The claims are to "the bevel on the face of the wheel, the use of which is to admit the lumber to enter between the carriage and the verge of the wheel, and thereby present the part to be planed off to the action of the planes."

"The sliding motion of the wheel, by which various thicknesses may be planed."

"The running the lumber by the centre, and the metallic plates, the use of which is to answer the purpose of double irons, [by closing the mouths,] which principle is contemplated to be applied to hand planes."

---

38. For an improvement in the common *Churn, and in the mode of working it;* Talmage Ross, Pickaway, Pickaway county, Ohio, January 26.

The dasher of the common churn is to be moved up and down by a lever, working like a pump handle. No doubt it will work.

---

39. For an improvement in the *Sawing of Timber*, by water, steam, or any other power; Jeremiah Smith, Morris township, Morris county, New Jersey, January 27.

The saw frame, instead of working up and down between the fender posts, in the usual manner, moves in a curve, which the patentee terms an elliptical curve.

Two grooves are cut in each fender post, which are convex towards their fronts. Projecting pieces at the upper and lower ends of the saw frame fit into these grooves, and as the frame is moved by the crank, the direction of the saw is, of course, governed by the grooves.

"The saw," the patentee says, "thus striking the timber, or log, to be sawed, first by the lower end of the saw, and by that means clearing the timber or log of saw dust, and thus removing that incumbrance from it."

"The patent is required only for the elliptical motion of the saw; the ellipsis to be varied according as it may suit the views of the applicant."

---

40. For a *Rotary Pump;* Thomas Sutton, Norwich, New London county, Connecticut, January 28.

We have described several rotary pumps, and those who are conversant with hydraulic machines, are well acquainted with the principle upon which they in general operate. Toothed wheels taking into each other, or sliding valves variously constructed, are employed for the purpose of raising the water. In the present instance the sliding valves are used, and the mode in which they are moved is extremely ingenious, but a clear and adequate idea of the arrangement would require a view of the drawings. The great objection to most of these plans is a want of simplicity, which causes them to be difficult to make, and very liable to derangement by friction; we fear that these difficulties have not been overcome by the present patentee.

---

41. For an improvement in the *Art of Tanning;* Osmond Cogswell, Cincinnati, Hamilton county, Ohio, January 29.

(See specification.)

---

42. For a *Machine for Dressing Staves;* John G. Conser, Rebersburg, Centre county, Pennsylvania, January 31.

The stave is to be driven through an opening in a tool made of iron, or steel, the opening being of the size of the intended stave. This tool is to be fixed upon a block, and a ram, or driver, raised up by a pulley, and falling down between guides, is to force the stave endwise through the tool. The claim is to "the above machine for shaving or dressing staves."

To the judgment of the cooper, we must leave the estimation of the value of "the above machine." Were we to venture an opinion upon so recondite a subject, we should say that such a machine might reduce staves all to one width and thickness, but that it would neither straighten them, or dress them, in the technical acceptation of the term.

---

43. For Machinery for *Cleaning Wool from Burs* and filth by means of Steel Combs, while the wool remains on the

skin; Lewis L. Miller, Rochester, Monroe county, New York, January 31.

A cylinder, resembling the large cylinder of a carding machine, is to have on it a number of rows of steel teeth about five-eighths of an inch in length; to this cylinder a revolving motion is to be given. A second cylinder, about a foot in diameter, is placed parallel with the former, and slides to and from it on a carriage. The skin to be cleaned is to be put upon this smaller cylinder, and fixed to it at one edge by a moveable strip. The feeding, or smaller cylinder, may be turned by means of a crank, the hand graduating it as may be necessary. The mode of using it will be obvious from the foregoing description.

"What the inventor relies on in this improvement, is in applying the combs in this way to cleaning sheep's wool from burs, cockles, and other filth common to wool, making the same article more valuable in market, at less than one-fourth of the common expense in cleaning."

---

44. For a *Washing Machine;* James Hinkley, Fayette, Kennebeck county, Maine, January 31.

A curved segment, formed of rollers, and a pendulous, or vibrating, rubber adapted to them, and having spiral springs to adjust it, are to operate within a tub or trough.

The patentee tells us that, "Although rubbers and rollers of various descriptions have been entered into machines, constructed for the purpose of cleansing or washing clothes, yet, I allege that the foregoing describes a new arrangement or construction of the parts, constituting a new conformation, and producing the effect by a mode of operation entirely new, and therefore claim it as my invention."

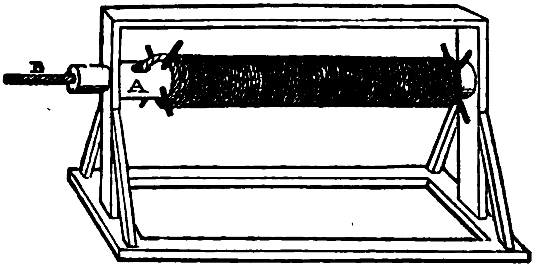
"He must have optics good, I ween."

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the manufacturing of Ropes. Granted to EDWARD S. TOWNSEND, *and* PHILO DURFEE, *Palmyra, Wayne county, New York, January* 6, 1831.

THIS machine is composed of a shaft, or reel, used in place of a wheel or crank, to give the twist or turn for laying strands or rope; so that a strand or rope can be twisted or laid in certain lengths at a time, until a rope or strand is twisted or laid of any required length. The shaft to be fixed to revolve on proper supports, (in boxes, or gudgeons, &c.) made of proper materials, with a hole passing into the side and out at the end, so that when a rope or strand is coiled on the shaft, the end of it can pass through the eye thus made in the end of the shaft, not interfering with the supports; thus giving a chance for spinning to it another length of yarn; then the shaft being turned, gives the turn for the laying of strands or rope, which, when so laid, is again to be reeled, leaving the rope out as before: thus on-laying, and spinning, until any required length is finished. The chief object is to make a rope of any assignable length in one piece, by laying it in portions of convenient length, and spinning into the threads of the end of such parts as is already laid. In laying several ropes into a layer, or tarred yarn into a rope, the reels or machines must be equal to the number of strands and rope, and may remain stationary, or be placed on slides, or truck wheels, as may be necessary.

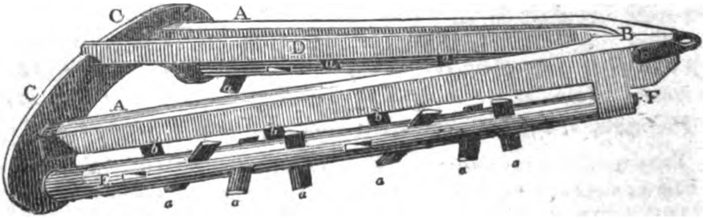
Edward S. Townsend,
Philo Durfee.



A, shaft. B, rope passing out at the end of the shaft.

Specification of a patent for an improvement in the mode of making Harrows for the purposes of agriculture, called Revolving Harrows. Granted to Samuel Rugg, *Lancaster, Worcester county, Massachusetts, January* 11, 1831.

This improvement in the harrow is more particularly described as follows, and I refer to the drawings of the same accompanying this specification, and the model deposited in the office, for a more complete and full understanding of the improvement.



In the drawing, A, A, are two horizontal bars forming a triangle, and joined at B.

B, is the forward part of the harrow.

C, C, the junctions of the bars at the other end of the frame and with A, A, and B, constituting the whole frame.

D, a brace running from B, to a middle point between C, C, and is also extended as a runner when the harrow is turned over on its back, for the purpose of being drawn over the ground without obstruction.

E, E, are two cylindrical rollers which come near together at the point F, and revolve at each end on their axes. These cylinders diverge till they reach the part of the frame C, C, where they are inserted, and may be made to constitute, at pleasure, either a greater or less angle than A, A.

a, a, a, &c. are iron teeth, part of which are visible in the drawings. These teeth are mortised into the rollers, the same number in each roller, and pass entirely through, and have sharp edges, with backs, resembling in some degree the blades of penknives, and varying in size with the size of the rollers and frame. These teeth may be grooved, or made concave on one side, or may be of plain surfaces.

b, b, b, &c. some of which are visible in the drawing, are pieces of iron inserted in A, A, and extending downward towards the rollers, for the purpose of clearing them from sods, earth, or other obstruction.

The mode in which this harrow is worked is as follows. The power is applied at the end near to B. The rollers are thus immediately put in motion, and continue revolving in opposition to each other; that is, revolving in opposite directions, and outwardly from the frame on either side. This improved harrow is very useful in cross furrowing, and particularly so in subduing rough land, and soils that are stubborn, either from roots, or otherwise; and breaks up and mellows the land with great advantage. It is also easier for draft than the common harrow of the same size.

The principle to be secured is the revolving principle as applied to the harrow. The form is of less consequence. The petitioner contemplates the use of his improved harrow in other forms; for instance, the bars A, A, may be brought nearer together than C, C, or may be entirely removed, and D only retained. E, E, may be made to diverge more or less, or work in parallel lines, and revolve either way by varying the form of the teeth; and a single roller may be used with a handle at the end opposite to the draft, for light harrowing, or cross furrowing. SAMUEL RUGG.

Specification of a patent for an improvement in the composition of Matter used in stiffening wool and fur hats and caps, by the use of Indian rubber, (elastic gum,) either in combination with gum shellac, or alone. Granted to LABAN L. MACOMBER, *Gardiner, Kennebeck county, Maine, January 19th,* 1831.

BE it known that I have invented a new and useful improvement in the composition of matter to be used in stiffening wool and fur hats and caps, by which they are rendered so elastic as to be folded into a small compass, and packed with clothes in the trunk of the traveller, or elsewhere, as convenience may require; after which they can be made to resume and keep their original shape; by using elastic gum, (Indian rubber,) either in combination with the gum shellac, or alone. If used with shellac, I dissolve the elastic gum in spirits of turpentine, or any other suitable solvent, and the shellac in alcohol, or any other agent proper to dissolve the same. If used alone, I dissolve the elastic gum aforesaid in spirits of turpentine, or other solvent.

What I claim as my invention is, the use of gum elastic, either alone or in combination with gum shellac, as aforesaid, in stiffening wool and fur hats and caps, so as to render them elastic to such a degree that they may be folded and packed, and then restored to their usual shape aforesaid, and also to render them water proof.

Laban L. Macomber.

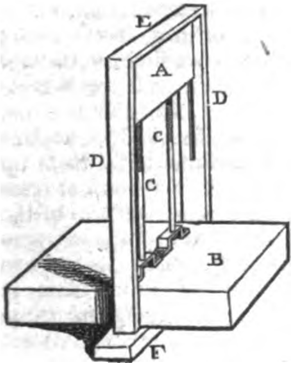
Remarks by the Editor.—A patent was obtained in England, some years since, for applying gum elastic, in combination with shellac, and other resins, to the stiffening of hats, and rendering them water proof. We do not now think it necessary to turn to the patent; but if any one doubts the correctness of the assertion, we will do so, and, if desired, publish the specification.

Specification of a patent for a machine called the Self-regulating Conduit; for passing water around canal locks, from a higher to a lower level. Granted to James Clarke, *Westmoreland county, Pennsylvania, January* 25, 1831.

The bottom of the conduit, connecting with the upper level of the canal, must correspond with the bottom of that level, and be carried to such a point between the upper and lower levels of the canal as shall be found most convenient for the construction of the regulating gate; the lower level of the conduit must be on a plane with the lower level of the canal, or may be sunk as much lower as the particular circumstances of the case may require. The dimensions of the conduit must be regulated in proportion to the quantity of water which it is intended to vent. At the connexion of the two levels of the conduit, the regulating gate must be placed, and constructed in the following manner.

Two, or more, mud sills are framed together, and are placed horizontally at the bottom of the lower level of the conduit, into which two upright gate posts are placed, one on each side of the conduit, and extending from the bottom of the lower to the top of the upper level; these posts to be supported by a cap sill, braces, and longitudinal frame work, covered with plank extending each side of the gate, so as to conduct the water towards the gate, and to serve as an apron to convey the water over the air box, buoy, or float. A groove or rebate must be cut in each of the gate posts, so as to receive the gate, and extending from the top of the posts downwards, a sufficient distance, to admit the top of the gate to be drawn down to the bottom of the upper level of the conduit. When the size of the gate shall be such as to prevent it sliding easily in the grooves, or rebates, metals, boxes, or friction rollers, will be placed so as to admit a free action of the gate.

The gate must be constructed of plank well jointed and secured together, and be of a height corresponding with the greatest depth of water intended to be maintained on the upper level. This gate is connected with an air box, buoy, or float, placed in the lower level, which box, buoy, or float, must be of a size and buoyancy sufficient to raise the gate as the water shall rise in the lower level. This box, buoy, or float, is connected with the gate in the following manner. Two, or more, screws, are required with flat heads, resting on the top of the box, buoy, or float, and secured to it by metal plates, having holes in them sufficiently large to admit the shank of the screw to pass upwards through them. When these plates are fastened to the box, buoy, or float, the heads of the screws will turn under them in the manner of a swivel. Holes corresponding with the screws must be bored in the lower edge of the gate, and be of sufficient depth to admit the box, buoy, or float, and the gate to be screwed together, or apart, so as to maintain any required quantity of water on either level. Screw nuts must be placed in these holes so as to govern the gate. The screws are provided with holes in their shanks, near the box, buoy, or float, to admit the end of a turning bar or lever, for the greater convenience of working them. When it is intended to maintain a greater quantity of water on the upper than the lower level, the gate must be screwed from the box, buoy, or float; when the greater quantity is required on the lower level, the gate must be screwed towards the box, &c.—The operation of the machine will be as follows. The water, in passing the conduit, will flow over the top of the gate into the lower level; as the water rises in the lower level, the buoyancy of the box, buoy, or float, will force the gate upwards until the required quantity is obtained in the lower level, when the upper section of the conduit will be closed by the gate. Should the water sink in the lower level, the weight of the box, buoy, or float, will draw the gate downwards, so as to admit the water to pass over its upper edge, thus producing a regular supply, and such depth of water in the canal, at all times, as may be desirable.



James Clarke.

A, regulating gate.
B, air box.
C, C, screws.
D, D, gate posts.
E, cap sill.
F, mud sill.

Specification of a patent for an improvement in Tanning. Granted to Osmond Cogswell, *Cincinnati, Hamilton county, Ohio, January* 29, 1831.

The improvement consists in applying a solution of oak or other bark to hides or skins, in such manner, as that when the glutinous particles of the hide have absorbed and become mixed with the tanning, or astringent principle, the other part of the solution (viz. the water,) may pass off and leave the hide free to receive more of the solution, and so on till it is tanned. The object is to expedite the process of tanning, and consequently to diminish the amount of capital necessary to be employed in the business.

The *apparatus, and mode of application* is as follows. Make a frame of timber of a square form; the width to be made as great as the width of the hides, parts of hides, or skins, that are to be tanned; the height and length to suit convenience. Near the bottom, or ground of said frame, a tight floor is to be formed of the length and breadth of the frame; said floor to incline to one side so as to carry off the liquor after it has passed through the hide; the sides and ends to be raised from two to four inches above the floor, by fastening strips of plank on the inside of the frame; this will appear like a box; say four feet wide, two inches high on one side, and four on the other, and twenty feet long; (these boxes may be fixed one above another, about twelve inches apart to the top of the frame;) said boxes to be filled with *saw dust*, or any other soft porous substance, that will not prevent the solution from running through the hide, and at the same time absorb and carry it off after it has passed through. On this surface, (of saw dust,) the hides, sides, or skins, (after having been prepared in the usual mode for tanning, except that the flesh is to be taken off clean,) are to be smoothly spread out, and in order to keep on them a sufficient quantity of the solution, make sacks of coarse cotton or other cloth, an inch or more in diameter; fill them with the same material that the boxes are filled with, and place them around under the edges of the hides, which will raise said edges equal to the diameter of the sacks. After this is done, pour on the hides as much of the solution as the hollow surface which they will then present will hold, and continue to fill them up as it runs off through the pores of the hide, for the space of from three to fifteen days, (the time in proportion to the thickness of the hide or skin,) in which time they will be tanned, except the extreme parts or edges, which cannot be brought so fully under this process as the other parts of the hides: and in order *perfectly* to tan *them*, it is necessary to lay them in vats after the common mode, for three or four weeks.

Osmond Cogswell.

Specification of a patent for an improvement in the process of Distilling. Granted to James L. Jenks, Sacket's Harbour, New York, May 2nd, 1831.

To all whom it may concern, be it known, that I, James L. Jenks, have invented an improvement in the process of distilling, by which alcohol, or spirits of any desired proof, may be obtained at one operation, and that the following is a full and exact description of my invention, and the manner of carrying it into effect.

The separation of ardent spirits from water, or from vinous liquids, by distillation, in whatever way the process may be performed, depends upon the different degrees of heat at which these fluids are converted into vapour; and the strength of the spirit obtained, is governed by the manner in which the condensation of the vapour is effected. My invention consists in an improved construction and arrangement of the condensing apparatus, by which the whole, or nearly the whole, of the water which rises in vapour with the spirit, is condensed and returned into the still, whilst the whole, or nearly the whole, of the spirit, is subsequently condensed, and passes over into the proper recipient.

For the purpose of giving a clear view of my apparatus and mode of procedure, reference may be had to the annexed drawing. In this, A, represents the arch and still, with the usual appendages, having a boiler for the use of steam. The still, as shown, I have converted into a spirit still, by putting a stopper through the supply pipe, B, near to the supplyer, C, and inserting another pipe, a segment of which is shown at D. This pipe leads up to a reservoir from which the still may be supplied with spirit. At the bottom of the supplyer, C, there is a valve, regulated by a float in the still, an arrangement well known to those who distil by steam. The tub E, contains the ascending worm, to be presently described. This worm may vary in length and size, but it is best when made of about one hundred feet in length, and having a bore of about three inches at its lower end, and for one half of its length; and of about two inches in its upper half. F, is the ordinary condensing worm and tub; G, the recipient; H, the platform on which the tubs stand; and I, the penstock for supplying cold water, with the arms or tubes attached to it.

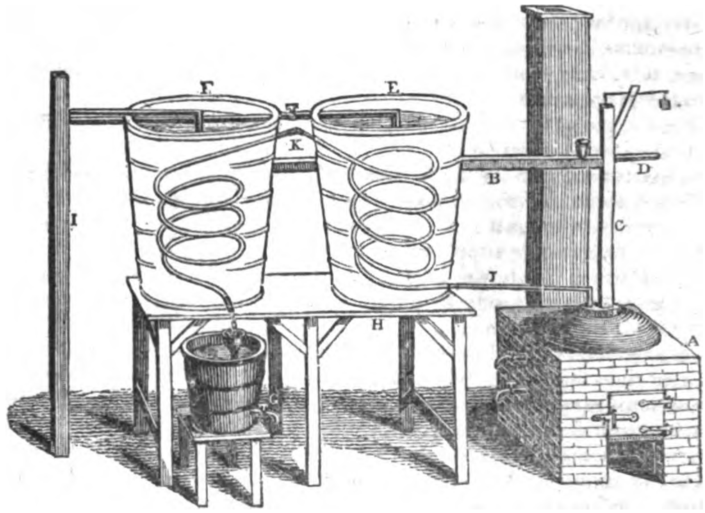
The beak of the still, or the tube, J, has a slight ascent, as it proceeds from the still to the ascending worm. The tub, E, is filled with water, the temperature of which I elevate to 176 degrees of Fahrenheit's scale, and sometimes higher, depending upon the strength which is intended to be given to the spirit. To heat the water in this tub, I first charge the still with water, the fire is then raised, and the vapour from the water will produce the desired effect, the heated water is then drawn off, and the still charged as usual.

The upper end of the ascending worm, and of that in the refrigeratory, F, are connected together, as shown at K. The water will by this means be nearly, or entirely, separated from the spirit.

It is not absolutely necessary that the beak of the still should be connected with the *lower* end of the worm in the tub which contains heated water, as the same effect may be produced by connecting it with the *upper* end, and the connecting the lower end of this worm with the final condenser; attaching a tube at the junction of the two in such a manner as shall enable it to return the condensed water, or wash, into the still. Such an arrangement I consider the same in principle with the former.

What I claim as my invention, and for which I ask a patent, is the placing of the tempered refrigeratory, with its worm, between the still and the usual condenser, in the manner and for the purposes set forth in this specification.

JAMES L. JENKS.



Remarks by the Patentee.

It is not pretended that either time, or fuel, is economized by using steam as the prime heater, in converting spirits, already distilled, into alcohol; but, so far as regards the use of steam, my object is to enable the distiller, who already uses steam in the process of distilling the low material, to draw off his spirit as high as he pleases, at a single operation. I have made many experiments upon this point, all confirming the correctness of the principle upon which I have proceeded. The apparatus which I have in use, however, has an ascending worm of only seventy feet in length, whilst it ought to be one hundred, with a bore of only two inches. The consequence of which is, that the spirituous vapour passes over the apex, when the refrigerator is at a temperature lower than that at which spirits boil.

In an experiment made with water only, to ascertain what must be the temperature of the refrigerator to allow its vapour to pass over, not a particle was obtained until the temperature was 186°, and but a minute quantity at 196°.

When I mixed two quarts of spirit with 150 gallons of water, the spirit came over when the refrigerator stood at 170°; but owing to the small proportionate quantity of spirit, the quantity eliminated was insufficient to fill the worm, the ingress of atmospheric air, at a damp season, had, consequently, the effect to reduce it to 71 per cent. above proof, by the New York standard hydrometer.

I charged my tub with 104 gallons of proof spirit, the refrigerator standing at 164°. Spirit came over immediately after boiling. Some samples taken were 90 above, and after drawing off 45 gallons, with the refrigerator varying from 164° to 168°, the whole, when mixed, was 85 per cent above. I then changed casks, turned my temperature regulator, and allowed the refrigerator to run up, and when the remainder of the spirit was drawn off, it was 73 above.

It may be perceived, therefore, that by this simple process, alcohol is readily obtained from a very low wash, without the use of alkali, or any other agent having an affinity to the water, and that at a single operation.

Documents relating to the Royal Ordinance of France, (1823,) *concerning High Pressure Steam Engines.*

[TRANSLATED FOR THIS JOURNAL.]

(Continued from page 279.)

Circular of the 19*th of May,* 1825, *to the Prefects of Departments.*

I HAD the honour to transmit to you, in conformity with the 8th art. of the ordinance of October 29th, 1823, instructions in relation to the measures of precaution to be observed in the use of high pressure engines.

Scientific questions of importance, requiring numerous and accurate experiments, and the assistance of the Academy of Sciences, were to be resolved in order to the preparation of a second set of instructions, relating to the proof to be borne by boilers, previous to their use, and to the fusible disks with which they are to be provided.

These instructions are now transmitted to you; they have been drawn up by the Board of Engineers of Mines, and of Civil Engineers, which was assembled to put in execution the ordinance of October 29th, 1823; and have been approved, May 7th, by his excellency the Minister of the Interior. I inclose — copies.

You will find, accompanying this,

1st. A table of the elastic force of steam at different temperatures, drawn up by the Academy of Sciences.

2nd. The ordinance of October 29th, 1823, in relation to high pressure engines.

As an acquaintance with these documents is indispensable to the manufacturers of high pressure boilers, and as they interest those who use the engine, I request you to send copies to both these classes of persons, so that they may not be ignorant of any of the articles to which they are obliged to conform.

The numbers in the table* referred to, are only approximate. The Academy of Sciences is of opinion that the temperatures corresponding to the elasticities, are not more than two or three degrees from the truth, even in the highest parts of the table; so that no practical inconvenience need be feared, in following the measures of precaution.

The Academy is now engaged in the experiments necessary to make this table accurate, and also to determine the dimensions which should be given to safety valves. I will communicate their results as soon as the experiments are concluded.

You know that if there is no resident engineer of mines in your department, the government civil engineer must, according to art. 7 of the ordinance, supply his place, and superintend the proving of boilers, and of their fusible plates. This engineer should visit every work, at least once a year, examine the boilers which are in use, and induce the removal of those, the use of which he may consider dangerous.

I request you to inform the makers of high pressure boilers, and those who use them, who are obliged, by the terms of the ordinance, to have boilers proved and marked, that they must apply to you, that you may direct them to the engineer who is charged with such duty, and may give, at the same time, to this engineer, the necessary instructions.

When you shall have informed me that there are works for manufacturing boilers, in your department, I will send you,

1. A die to stamp the fusible disks; also, a second die, in case of accident to the first, or to supply an adjacent arrondisement.

2. A die, having a *fleur de lys* sunk upon it, with which to mark the screws attaching the fusible plates to the boiler. (There will also be a second die of the same kind.)

These dies will be placed in the keeping of the engineer.

I send you three models of each die. One of them will be deposited in the archives of your department, the others will be sent to the engineer charged with the inspection of boilers.

If more of the articles sent are wanted, for the different arrondisements of your department, I will send a further supply, upon your requisition.

You will not forget that the 7th art. requires of the local police, a constant surveillance of the works where high pressure engines are used.

In case of an infringement of the ordinance, the proprietors of the works will be liable to their stoppage, without prejudice to the penalties which may be awarded by the courts.

---

* The use of this table having been superseded by the publication of one, drawn from the recent experiments of Arago and Dulong, it is not appended to this translation.—[TRANSLATOR.

It is your duty, Mr. Prefect, to make such arrangements for this surveillance as may seem most proper to you. Human life depends upon the observance of the ordinance and instructions, which have the further object of securing manufacturers from serious losses.

I request you to see to the execution of the rules prescribed by the ordinance and instructions, and to acknowledge the receipt of these.

(Signed,) BECQUEY.
Counsellor of State, &c.

Second Set of Instructions in relation to the execution of the Royal Ordinance of October 29th, 1823, concerning High Pressure Engines.

THE royal ordinance of the 29th October, 1823, requires that no boiler shall be sold, much less used, until it has been provided with two safety valves, and two disks of fusible metal, and also has been proved by the hydraulic press, and marked after the proof.

Those makers of high pressure boilers who may have boilers to be proved, will inform the Prefect of the same, who will transmit the information to the engineer of mines, residing in the department, or else to the government civil engineer, who is to supply his place. (Art. 7 of the Ordinance.)

The Prefect will take care that these operations, relating to the proof, are conducted with as little delay as possible, that no inconvenience may result from them to the arts. The engineer will ascertain, first, if the safety valves are of the proper dimensions. He will ascertain also, if the apertures to be covered by the fusible plates are of the proper sizes; that is, if one has a diameter at least equal to that of one of the safety valves, and the other at least twice this diameter. He will further satisfy himself that the position of these plates is such that they will fulfil their object.

The boiler will not be proved until after the fusible plates are applied. The fastening of the plates to the boiler will be preceded by the operations now to be described. The engineer must determine from the table hereunto annexed, the degree of the thermometer at which the metallic plate to be used, must fuse. He will next ascertain whether the metal proposed to be employed has the requisite fusibility; this may be verified in two ways.

1st. If the metal has been prepared by the maker of the boiler, the engineer will proceed to determine the temperature at which each of the ingots to be employed will fuse, using the apparatus employed by the maker for the purpose, if he is satisfied of its accuracy.

2nd. If the metal is that used in commerce, the engineer will merely satisfy himself that it bears the legal stamp designating its fusibility, which has been affixed, by the engineer of mines intrusted with making such trials, in the manufactory of the metal: this stamp will be of the kind spoken of in the next paragraph.

The engineer, having ascertained that the alloys, of which the plates are to be made, fuse, at 18° F. and 36° F., respectively, above the temperature of the steam of ordinary working pressure, will have the two disks cast in his presence, and will place upon each an octagonal stamp with the motto, "Civil Engineers of Mines;" and in the middle of this stamp he will have, immediately, engraved the degree of fusibility of the disks. The disks will then be fixed upon the boiler.

If the maker of the boiler shall have procured disks already tried and stamped, the engineer will have no other trouble than to examine the stamps, indicating their fusing points, before having them affixed to the boiler.*

The engineer should attend to the fact that he is not in search of the precise temperature at which the plates fuse, but of that at which the plate becomes so soft as to yield to pressure. This distinction is important, because the plates of fusible metal lose their tenacity before they melt. The stamp should therefore denote, not the temperature of perfect fusion, but that which softens the metal so much that it will give way to a pressure corresponding to this temperature.†

The boiler tubes having been attached to the boiler, as well as the fusible plates and the safety valves, (duly loaded,) the boiler must be filled with water, and proved by means of a forcing pump, or of a hydraulic press, to be furnished by the manufacturer, who shall also provide the labour necessary to its use.

The proof pressure must be five times that at which the engine, to which the boiler belongs, is to be worked; for example, if the boiler is to contain steam of two atmospheres, the proof pressure must be carried to ten atmospheres.

When the boiler may have resisted such a pressure, the engineer shall have it marked, in his presence, with the number showing in atmospheres the pressure under which the boiler is to be worked.

The apparatus for marking shall consist, first, of a circular plate of copper, struck at the mint of Paris, bearing an inscription, *Ordinance of October 29th*, 1823; upon this the number of atmospheres and half atmospheres, shall be marked; 2nd, of three screws, of the same metal, intended to fasten the plate to the boiler. After the screws have been inserted and tightened, the engineer shall have the head of each cut off even with the plate, so as to erase the groove on the head. He shall then have a fleur de lys stamped upon each head by a die larger than the head itself.

The plate and screws shall be furnished by the manufacturer.‡

By means of the method just described, all high pressure boilers will be proved where they are manufactured, which will confine the proving to a few departments.

If there is no manufactory of boilers in a department, the duties of the engineer, in relation to boilers, introduced into the department, either for the use of high pressure engines already licensed, or which may hereafter be licensed, will be limited to ascertaining that they have the two proper marks. This can easily be done by means of the models.

---

* Manufacturers will find fusible metal, prepared according to the directions of M. Gay Lussac, Member of the Royal Academy of Sciences, at the store of M. Collardeau, &c.

† In this paragraph, the great advantage of the fusible plate over the safety valve, viz. that it yields by the effect of temperature, and not of pressure, seems to have been lost sight of: to have followed such a direction to the letter, would have been to reduce the efficacy of the plate most materially, by depriving it of the power of guarding against the explosions resulting from a defective supply of water within the boiler.—[Trans.

‡ Manufacturers may procure them, at cost, at the Royal Medallic Mint, &c.

One of these models is deposited in the Archives of the Prefecture, the other in the office of the Engineer of Mines, or in that of the Government Civil Engineer.

(Signed,) Becquey, *Counsellor of State, &c.*

Approved.

(Signed,) Corbiere, *Minister of the Interior.*

Paris, May 7th, 1825.

On the first invention of Telescopes, collected from the notes and papers of the late Professor Van Swinden. *By* Dr. G. Moll, *of Utrecht.*

The late Professor Van Swinden had been at considerable pains to illustrate some important points in the history of natural philosophy. The first invention of telescopes in Holland attracted a considerable share of his attention, and he had the good fortune to meet with some official documents, which are calculated to throw some light on the mystery in which the early history of this celebrated invention is involved.

Mr. Van Swinden exposed the result of his labours in several public lectures, and he intended to publish a paper on the subject: his death prevented the accomplishment of this purpose. He left, however, the sketches of his lectures, together with extensive notes, and abstracts from various writers, which he had collected with great industry. These papers were committed to my hands, and the result of what I collected from them has been ordered to be printed by the Royal Institute of the Netherlands.

The little which is known of the first invention of telescopes in this country has been principally derived from two sources: first, from the book, which the French physician, Pierre Borel, wrote on the subject in 1655, probably at the request, and certainly with the assistance, of William Borel, at that time ambassador of the States at the court of France.* The second source from which information is generally derived, is a passage in Descartes's Dioptrics,† in which he attributes the invention to a citizen of Alkmar, called James Metiús. Both the versions of Borel and Descartes are usually given in books written on this part of natural philosophy, and very recently they were repeated in the very excellent account of the life of Galileo, published in England, and in the still more recent and capital work of Professor Littrow on Dioptrics.

---

* De vero Telescopii inventore, cum brevi omnium Conspicilliorum historia, authore Petro Borello, Regis Christianissimi consiliario et medico ordinario; Hagæ Commit. ex typogr. Adriana Vlacq. 4to. 1655. Pierre Borel was a native of Chartres, and author of several other books: he died 1689. A copy of this very rare tract has been recently added to the library of the Royal Institution. It contains a portrait of Lippershey.

† Cartesii Dioptrica, p. 49.

The real name of this Metiüs of whom Descartes speaks, and who is also mentioned by Huygens, was Jacob Adriaansz. His father Adriaan Anthonisz was a man of considerable knowledge for his time; he possessed a great influence, and took a principal part in the struggle with Spain. In consequence, he was banished by the Duke of Alva, and his property confiscated. He contributed very essentially to the glorious defence of his native town against the Spaniards in 1592. He was created afterwards inspector of fortifications, and many towns were fortified on his plans. As a mathematician he is celebrated for his expression of the ratio of the diameter and circumference of the circle, by the numbers 113 and 355. At that time Ludolf van Ceulen had not given his celebrated number, and the ratio of Archimedes, of 7 and 22, was in general use. The numbers of Anthonisz have the merit of being easily kept in memory, and of being as accurate as almost any purpose requires. If no logarithms are used, it is easier to calculate than Ludolf's number.

There is another problem remaining of this Anthonisz, which shows his ability as a mathematician: it is recorded in one of the writings of his son Adrian, and Delambre notices it in his history of astronomy. The problem was solved by Nicholas des Muliers of Bruges, then professor of mathematics in Groningen.

All the four sons of Adriaan Anthonisz were mathematicians like their father. The eldest, Dirk or Theodore, was an engineer and surveyor in the service of the States. He sailed in that capacity in the expedition against the Spanish colonies in the West Indies and the coast of Africa, sent out under Admiral Peter Van der Does in 1599. He died in that ill-fated expedition.

The second son, Adrian, whilst at the University, had the nickname of *Metiüs* given to him by his fellow students, on account of his propensity to mathematics. He became generally known under that name, and wore it through life. His father sent him to Hueen to study astronomy under the celebrated Tycho, and afterwards he visited several universities of Germany. He filled the astronomical chair at the university of Franeker with great credit, and died in that place in 1635. His works were very numerous and celebrated in their time, being considered the best elementary works then extant. Delambre seems to have known only one of Metiüs' books, of which a complete catalogue is to be found in Vriemoet.*

The fourth son, Anthony, did not rise to such extensive fame: however, he also served his country as an engineer.

The third son is the person whom Descartes designates as the inventor of the telescope. His name was Jacob Adriaansz; and sometimes the name of Metiüs, which properly belonged to his brother, was given to him. This Jacob or James, died between 1624 and 1631. Contemporary writers describe him as a person of eccentric and fanciful habits, buried incessantly in deep meditations, and of a temper so little communicative that he very seldom spoke to any one about the subject of his studies. It is well known that such an eccentric turn of mind is not incompatible with mechanical genius, and in England and elsewhere the most consummate skill has often been blended with most singular habits. It appears, from the evidence of writers of that time, that this Jacob had acquired considerable skill in working glass, and excelled, amongst other things, in the construction of large burning lenses. It is said that he once placed a large lens on the walls of Alkmar, and predicted that at a certain hour of the day it would set fire to a tree standing at a great distance on the other side of the moat. At the request of Prince Maurice of Nassau, who was a great proficient in mechanics and mathematics, many and pressing solicitations were made to make Jacob explain how this, and other apparatus which he contrived, were executed; but he obstinately rejected all offers, and always refused to give the least information, even on his death-bed, when strongly urged by a clergyman, at the request of his relatives. It must be allowed that at that time, and even now, the construction of a burning lens of such power was a matter of great difficulty, and even at present very few artists would be capable of doing the same. So strong was his desire to conceal his inventions, that before his death he caused his apparatus and tools to be destroyed.

---

*Athenæ Frisiacæ.

This eccentric character sent a petition to the States General of the United Provinces, dated 17th of October, 1608. An original copy of this document, made by a public notary in the most authentic form, is existing in the library of the university of Leyden, amongst the manuscripts of Huygens. In this document it is distinctly asserted that this person actually invented the telescope. He calls himself Jacob Adriaanszoon, son of Mr. Adriaan Anthoniszoon, and he goes on to state, "that since two years, he employed all the time which he could spare in inquiring into some occult or secret arts connected with glass making. That he found that, by means of a certain instrument which he was making for another purpose, the sight of persons using it might be extended, so as to make objects which, on account of their distance, could not be seen or only distinguished with great difficulty, appear near and distinct. That since that time he applied himself to bring this invention to greater perfection, in which he succeeded so far as to make an object appear as visible and distinct by his instrument as can be done with *that which was lately offered to the States by a citizen and spectacle-maker of Middleburg*. That his excellency, (Prince Maurice,) and others who compared the instruments, convinced themselves of this fact, notwithstanding that his instrument was made of only coarse materials, and merely for the sake of experiment. That he has no doubt but that the contrivance, by improving the engine, might be brought to greater perfection, but that, besides, he believes and hopes to improve, in time, *the invention in itself*, so as to make it capable of doing great service. That he apprehends that, in the meantime, other persons might imitate his invention, building on the foundations which he had laid, by the grace of God, with his *ingenuity, great labour, and intense study*, and by these means might frustrate him, and rob him of the fruits of this invention, which he has a right to expect with great confidence; and therefore, he prays their High Mightinesses to grant him a privilege (*octroi,*) by which every one, *not possessing the said invention at present*, is prohibited from imitating this instrument, or even from selling or purchasing instruments made contrary to this privilege, without his express leave, and on a fine of a hundred florins on each instrument; and that this privilege is to last twenty years, or, instead of a privilege, to allow him such a remuneration as will be adequate to the utility and service likely to be derived from this invention."

In the margin of the petition the following appointment is written: "The petitioner is exhorted to make further investigations, to bring his invention to greater perfection; when his prayer for a privilege will be taken into consideration."

"*Actum*, 17 *October*, 1608."

With the signature of "Aersens," the then Secretary of the States.

If we are disposed to give full credit to Adriaanszoon, whom, for brevity sake, we will call *Metiùs* in future, it appears that he began the researches which led him to the invention of the telescope as far back as 1606; that the invention was due to chance, and occurred while its author was trying other experiments; that he spent subsequently much time and labour upon it; but that in 1608, when he sent in his petition, his instrument was made of bad materials, and might be much improved. At the same time he readily admits that another person, *a spectacle-maker of Middleburg*, had offered before him a similar instrument to the States, which had been tried by Prince Maurice and other persons, and he gives us to understand that his instrument is equal to that of his competitor. Nothing is said which enables us to judge of the performance of either instrument.

Mr. Van Swinden examined the written Acts and Journals of the States General of that time with great care. These papers are kept at present among the state archives in the Hague. Under the date of the 2nd October, 1608, the following entry is made:—

"*Jovis*, 2 *October*, 1608.

"On the petition of *Hans Lippershey*, a native of Wesel, an inhabitant of Middleburg, spectacle-maker, inventor of an instrument for seeing at a distance, as was proved to the States, praying that the said instrument might be kept secret, and that a privilege for thirty years might be granted to him, by which every body might be prohibited from imitating these instruments; or else to grant him an annual pension, in order to enable him to make these instruments for the utility of this country alone, without selling any to foreign kings or princes. It was resolved, that some of the Assembly do form a committee, which shall communicate with this petitioner about his said invention, and inquire of him whether it would not be possible to improve upon it, *so as to enable one to look through it with both eyes;* and further, to inquire what remuneration would satisfy him. And due report being made, it will be laid in deliberation, whether it is expedient to grant to the petitioner a remuneration or a privilege."

From this document it appears who this inventor was, whom Metius designates in his petition of the 17th of October, and whom he allows to have anticipated him in presenting a telescope to the States: it was the spectacle-maker of Middleburg, born at Wesel, and called Hans, *i. e.* John Lippershey. This man offers to keep his invention a secret; and he intimates a belief that it might be of service. This story offers also a ludicrous instance of the strange vexations to which ingenious men must often submit, from ignorant but official persons; this is—

> "The insolence of office, and the spurns
> That patient merit from the unworthy takes."

Here comes Lippershey, tendering to the States an invention, which, in its further progress, is entirely to alter and to extend all our notions of the universe—an invention which bodes a complete revolution in navigation and astronomy, and the first thing which these wise men think of, is to lay the inventor under the obligation of making a telescope through which *one could see with two eyes.*

Two days afterwards, the 4th of October, 1608, we find the following entry upon the Journals of the States:—

"*Sabathi*, 4 *October*, 1608.

"Resolved, that inclusive of the communication held the 2nd instant with Hans Lippershey, a native of Wesel, inventor of the instrument to see at a distance, one person from each province will be named, to examine and to try the said instrument on the turret of the mansion of his Excellency (Prince Maurice,) and to investigate whether it is likely to be of such utility as is generally believed; and, in such a case, to treat with the inventor, that he undertakes to make three such instruments of *rock-crystal*, (*christael de roche*,) for which he asks a thousand florins a-piece;-that he moderates his charge, and promises never to transmit his invention to anybody."

In this piece we have the counterpart of what happened to Galileo at Venice. Here we have the members of the States-General ascending the turret on Prince Maurice's house, to examine a distant object with the newly invented spy-glass, as the Venetian senators mounted the steeple of St. Mark; and probably Lippershey was equally tired as the Italian philosopher, with showing off his instrument to persons requiring telescopes to make them see with two eyes.

The mention which, in this early stage of the invention, is made of rock or mountain crystal, appears very curious. It seems that in this beginning, the difficulty of procuring glass fit for telescopes was equally as great as it is now, and *rock* crystal was frequently resorted to in the construction of object-glasses. This appears, among others, from a passage in Hevelius, who, however, gives the preference to glass. At this present day the Parisian optician, Cauchoix, constructs telescopes of rock or mountain crystal, which he calls *lunettes vitro-crystallines;* but which, in my opinion, are inferior to glass telescopes of equal size. One consequence may be deduced from the circumstance of rock-crystal being used in the construction of these telescopes, which is, that this spectacle-maker must have been well skilled in his profession, inasmuch as it is much more difficult to work and to select crystal than glass.

The 6th of October following, mention is made again in the Acts of the States, of the subject of telescopes:—

"*Lunæ*, 6 *October*, 1608.

"The commissioners of the Provinces who have examined the instrument made by John Lippershey, spectacle-maker, and who have communicated with him, report that the instrument is likely to be of utility to the state, and that in consequence, they offered to the inventor to make such an instrument of rock-crystal for the state, at the price of three hundred florins, payable immediately, and six hundred florins more when the instrument is completed and approved of. Resolved, to authorize these gentlemen, as is done by the present, to come to a final conclusion with Lippershey, about the making of the said instrument, and to limit him a time within which the instrument is to be completed and delivered in good order. And then the States are to deliberate whether a privilege or an annual pension is to be granted to the petitioner, under condition, that he will promise to make no such instruments, but with the consent of the States."

Whilst these transactions were taking place with Lippershey, Metiús, the second competitor, handed in his petition the 17th of October. Having gone so far with Lippershey, the States were perhaps at a loss how to dispose of Metiús's claim. They contented themselves with giving him some empty words of encouragement, and some vague promises for the future. After this time nothing more was done by Metiús to attract public notice. He doggedly refused to show his telescopes to anybody, not even to Prince Maurice, and least of all to his brother, the Professor of Franeker. Perhaps Jacob Metiús was disgusted with the little encouragement he received, and it is not unnatural to suppose, that a man of his eccentric habits, having once failed in his object, could not make up his mind to make a second attempt.

The petition of Metiús appears, however, to have had some influence on the manner in which the petition of Lippershey was disposed of.

We next find the following notes on the Record Book of the States-General:—

"*Jovis*, 11*th December*, 1608.

"The petition is read of Hans Lippershey, spectacle-maker, inventor of a certain instrument for seeing distant objects: no resolution has been taken on it, but Messrs. Van Dordt, Magnús, and Vander Aa, are appointed to speak with the petitioner about the said invention."

"*Lunæ*, 15*th December*, 1608.

"Messrs. Magnús and Vermanne report, in the absence of Messrs.

Vander Aa, and Boeles, that they examined the instrument invented by the spectacle-maker, Lippershey, to see at a distance *with two eyes*, and that they approved of it; in consequence of which it was proposed whether the privilege ought to be granted to the said Lippershey, of making alone the said instrument for a certain number of years, and to pay him the remaining six hundred florins which were promised him for the said instrument. Resolved, that whereas it appears *that many other persons have a knowledge of this new invention*, to see at a distance, it is expedient to refuse the prayer of the petitioner for an exclusive privilege, but that he will be commanded to make, within a certain time, two other instruments of his invention, for seeing with two eyes, for the same price; and checks are to be despatched to him for three hundred florins, and when the instruments are completed, of six hundred florins."

Lippershey used no delay in making the instruments, thus setting an example which the most eminent in his profession are said not to have always followed. The next mention is made of Lippershey in February, 1609.

"*Veneris, 13th February*, 1609.

"Hans Lippershey delivered the two instruments for seeing at a distance, which he was ordered to make, and in consequence it has been resolved to despatch checks of the three hundred florins remaining of the nine hundred which were promised him for three of the said instruments."

From these documents it appears that both Lippershey and Metiús failed in their attempt of obtaining an exclusive privilege. But certainly the instruments of the former were liberally paid for. Nine hundred florins, or *75l.*, for an instrument such as it can be expected to have been at that time, is certainly a high price; and even at the present time a very respectable telescope could be obtained for that money. From this circumstance we would be rather inclined to argue, that these instruments were not so roughly made as Italian authors, and those who follow them, are willing to persuade us. Our thrifty forefathers were too prudent and too economical to throw away considerable sums of the public money on things of bad manufacture and rough making.

Italian writers generally represent the Dutch telescopes as very imperfect. But how do these writers know this? Has Nelli, or any other, ever seen one of the telescopes of that time? If not, how can they judge of their performance? There is not the least necessity, in order to value the transcendent genius of a Galileo at its proper standard, to depreciate the merit of others; and we may admire Galileo without being unjust towards his contemporaries.

It is very remarkable that the absurd wish of the States to have an instrument which would enable them to see with two eyes, should have led to the invention of an instrument which has at present fallen into undeserved oblivion. It appears from the official documents, that Lippershey indeed gratified the wishes of the States, and that he produced an instrument with which they could see with two eyes. There can be little doubt but that this instrument was what was called afterwards *a binoculus*. The invention of this instrument is generally attributed to the Capuchin friar, Rheita,* who describes it in one of the most singular books which ever were written. For terrestrial objects a well arranged binoculus is perhaps the most pleasant telescope, but some dexterity is wanted to bring it to proper adjustment. It shows the objects considerably brighter and more distinct than a common telescope of equal power; and it has the great advantage of not straining and fatiguing the eye.

The readiness with which Lippershey furnished the States with the binoculus is a proof of considerable ingenuity, and must tend to do away with the notion that he was a low, ignorant mechanic, guided by mere chance.

The States, refusing to grant the privilege which Lippershey wished to obtain, gave as a reason of their refusal that the invention was *known to many*. Of this we have evidence in Metiús's petition; but we may find some more, in a book from which one would little expect to draw scientific information.

Negotiations, which terminated in a twelve years' truce, were then pending in the Hague, between the States and Spain. The ministers of the king of France, Henry IV. were the celebrated President de Jeannin and Monsieur Bussi. The letters which Jeannin wrote on the subjects of these negotiations to the king and his ministers have been printed, and amongst them we find something relating to the history of the invention of telescopes.†

Thus on the 28th of December, 1608, a few days after the States had refused the privilege to Lippershey, Jeannin and Bussi write to the king.

"The bearer, who returns to France, is a soldier of Sedan, who served some time in Prince Maurice's company.‡ He possesses several inventions for the war, and that form of glasses [the French has *lunettes*] which have recently been invented in this country by a spectacle-maker of Middleburg, by which one sees at a great distance. The States ordered the workman, who is the inventor of them, to make two for your majesty. We should not have required their favour, if the artist had been willing to make them at our own request; but he refused, saying, that he had express orders from the States, not to make them for any body. We will send them to your majesty on the first opportunity; and notwithstanding this soldier makes them as well (*aussi-bien*) as the other, as appears by the trials which he made, still the difficulty of making them is not great."

The same day the President writes to the minister Sully:

"The bearer of this letter is a soldier from Sedan, who belongs to the prince's company, and who is held very ingenious in many inventions and artifices of the war. He has also made, a few days ago, an engine, (*un engin,*) in imitation of that which has been made by the spectacle-maker of Middleburg, to see at a distance. He will show it to you, *and make you some for your sight.* I requested the first inventor to make me two, one for the king, and one for you; but the States prohibited him from making any but for themselves. They ordered some themselves to give them to me, that I may send them to you, which I will do the first day."

---

* Oculus Enoch et Eliæ, sive Radius sidereo-mysticus planetarum, Antwerpiæ, 1645, fol. p. 348, 354. See also Dioptrique Oculaire par le Pére Cherubin Le Gentil, Memoires de l'Academie des Sciences, 1778. Smith's Optics, p. 974.

† Lettres et Négotiations du Président de Jeannin. Paris, fol. 1656.

‡ In the Prince's guards.

The king's reply is very remarkable, being written about a year before that prince was murdered at the instigation of the Jesuitical faction. He writes thus the 8th of January, 1609:

"I shall see with pleasure the glasses which you mention in your letter, though at present I am more in want of such that can show me things near me, than of those which show distant objects."

Having thus shown what are the respective claims of Metiús and Lippershey, we must now consider those of a third pretender to the honour of the invention. This person was also a spectacle-maker of Middleburg, called Zacharias Tansz, and he has, more generally than Lippershey, been considered as the original inventor. The information of what we know about him must be wholly derived from Borel's book on the invention of telescopes. William Borel, who appears to have been very anxious about this matter, being himself a native of Middleburg, had all the persons then living, and knowing something on the subject, examined before the magistrates in 1655. Their depositions are given in Borel's book; but the originals of these depositions have not been found in the records of the town of Middleburg, although a very diligent search was made for them. In these documents, the places and houses in which both Lippershey and Zacharias Tansz lived, are frequently mentioned. These houses have since been taken down, and an open space now occupies the place where the telescope was invented.

Some of the witnesses, whose evidence is given in Borel's book, are in favour of Lippershey, and some in that of Zacharias. We must now carefully sift that evidence, and compare it with what Borel says on the subject, in a letter to Pierre Borel.

The first witness who occurs on the list is John Williams, a steward or beadle. He is seventy years of age, in 1655, and knew Laprey personally when he made spectacles. Afterwards he made telescopes, (*tubos longos,*) which he did about fifty years, when Laprey offered the first telescope to Prince Maurice, as he (the witness) heard at the time.

This witness brought the invention down to 1605, but he does not appear to have had a very clear recollection of the exact time of the invention.

The second witness is Edwold Kien. He is a messenger, aged sixty-seven; says that the man who made the telescopes was John Laprey, of Wesel; that he began making telescopes about 1610, and died in October, 1619. He (the witness) married the daughter of this Laprey. Laprey offered to Prince Maurice and to the States some of his telescopes, for which he got a reward, and a privilege for three years. He adds, that the sign of the house where Laprey lived was a *telescope.*

From a comparison of dates, it is obvious that this witness is mistaken, and that Lippershey made telescopes, and offered them to the States, long before 1610.

The third witness is a blacksmith of the name of Abraham Junius, aged, in 1655, seventy-seven. He says, that the name of the man who first made telescopes in this town was Hans; *i. e.* John, but that he did not observe the surname; that this man was commonly called John the spectacle-maker; that about forty-five or forty-six years ago this John made the first long telescopes; (*conspillia longa;*) that the witness knew him long ago, before he made spectacles, when he was a bricklayer; he assisted at the funeral of John; he knows, and heard very often, that John made long tubes (*tubos longos*) and telescopes for the use of Prince Maurice.

This witness brings the invention to 1609 or 1610, and very little is to be concluded from his evidence.

The Capuchin Friar, Rheita,* attributes also the first invention to Lippershey, whom he calls Lippensum. This is certainly no great alteration of the original name, not greater than that which is made by the English author of the Life of Galileo, who chooses to translate Borel's name into Italian, and calls him *Borelli*. According to the version of Rheita, the invention dates from 1609, when Lippershey happened to place a convex before a concave, and discovered, by chance, that the weathercock of a neighbouring church, and other objects, were magnified. He placed his glasses in a tube, and amused the visiters of his shop by showing them the weather-cock magnified, and larger than it could be seen with the unassisted eye. The Marquess of Spinola, happening to be at the Hague at the time, to negociate about the truce, saw this new instrument, bought it, and gave it to the ArchdukeAlbert of Austria, the Spanish Governor of Belgium.

In the mean time persons of high station (*proceres*) heard of the circumstance, and that other similar instruments had been constructed by the maker. The inventor was forced to sell his instrument for a great price; but he was prohibited from making or selling any more of them. In this manner, says the worthy friar, this noble and capital invention would have remained in obscurity, and hidden perhaps for ever, if it had not been transferred, by the will of God, to the court of Brussels, and made known there.

The Capuchin friar is mistaken in the dates, bringing the invention to 1609 instead of 1608. But besides, the Marquess of Spinola was not at the Hague in 1609. He left that city the 30th of September, 1608, together with the other Spanish ministers. That he left the Hague a little before Lippershey presented his petition to the States; but the Marquess, residing at the Hague, certainly could not see an apparatus which a spectacle-maker had erected in his shop at Middleburg; but, at all events, there is a possibility that Spinola, residing at the Hague in September, 1608, heard of the invention, and procured a telescope for the Archduke.

[TO BE CONTINUED.]

---

* Oculus Enoch and Eliæ, p. 337.

The nature and properties of the Sugar-Cane, with practical directions for the improvement of its culture, and the manufacture of its products.—By George Richardson Porter.

The author of the volume before us, informs us in his preface, that his attention has been particularly called to the subject of the manufacture of sugar, by the circumstance of his having obtained the grant of a patent for an invention, which he does not doubt will be eminently useful to the sugar planter, in the successful and economical manufacture of his produce; and further, that in attempting to supply the deficiency, which he has detected as arising from the want of any publication in our own language of adequate authority on the general nature of the subject, he has not relied alone on his own experience, but has availed himself of every source of knowledge to which he could obtain access.

In the first chapter, Mr. Porter endeavours to trace the origin of the sugar cane, and gives a brief sketch of its gradual progress throughout the world, to the time of its produce being considered almost a necessary of life in every civilized land. He then gives a description of the plant in its botanical character, as well as of its peculiar properties, and the manner of its secreting its juice; and proceeds to point out the influence of soil and climate in the cultivation, and the vegetable economy of the plant.

In the sixth chapter, in speaking of the expressed juice, he remarks—

The proportion and quality of the different juices vary, more or less, in the cane liquor, depending, not only on the kind of cane and the season, but also on numerous other local circumstances. The water which the liquor contains must be considered under two different relations; the one holding the mucus and mucilage in a saturated solution: this is called the water of solution, and, combined with these matters, takes the name of sirop; the second is the superabundant water, and is generally from sixty to eighty-five per cent. in quantity, over and above the water of solution.

In order to exhibit the relative proportions of water and sirop, we give the following table, taken from Dr. Dutrone's work; an authority which we have uniformly found so accurate, that we do not hesitate to take this table as a guide. It is constructed from experiments made with solutions of very pure sugar, taken at all degrees of the saccharometer. By means of the saccharometer and this table, the proportion of sugar contained in the expressed juice may be immediately ascertained, and the quantity of water which must be evaporated, to bring it to the point of saturation, can be accurately determined. It will also enable us to judge, by approximation, of the proportion of water and soluble matter contained in juices of middling and bad qualities.

Table of the quantity of Sugar contained in one hundred pounds of expressed cane juice or sirop of good quality; and also of the quantity of water that must be evaporated, to reduce the same to the state of saturated sirop, taken at each degree of the saccharometer.

Scale of Baume's Degrees.	Weight of Sugar in each 100 lbs. juice or sirop.			Weight of Water in each 100 lbs. juice or sirop, beyond the water of solution.			Specific gravities of solutions at each Degree.			
	lbs.	oz.	dr.	lbs.	oz.	dr.	Deg.	Sp. gr.	Deg.	Sp. gr.
1	1	13	6	97	..	15	1	1006	35	1312
2	3	10	12	94	1	14	2	1013	36	1324
3	5	8	3	91	2	13	3	1020	37	1336
4	7	5	10	88	3	12	4	1028	38	1349
5	9	3	..	85	4	10	5	1035	39	1361
6	11	..	7	82	5	11	6	1042	40	1374
7	12	13	14	79	6	9	7	1050	41	1386
8	14	11	4	76	7	8	8	1058	42	1400
9	16	8	11	73	8	7	9	1065	43	1413
10	18	6	1	70	9	6	10	1073	44	1427
11	20	3	8	67	10	5	11	1181	45	1441
12	22	..	15	64	11	4	12	1090	46	1456
13	23	14	5	61	12	3	13	1100	47	1470
14	25	11	12	58	13	3	14	1106	48	1485
15	27	9	2	55	14	1	15	1114	49	1500
16	29	6	9	52	15	1	16	1125	50	1515
17	31	4	..	50	..	..	17	1132	55	1618
18	33	1	6	47	..	15	18	1140		
19	34	14	13	44	1	14	19	1148		
20	36	12	3	41	2	13	20	1157		
21	38	9	10	38	3	12	21	1167		
22	40	7	1	35	4	11	22	1176		
23	42	4	7	32	5	10	23	1186		
24	44	1	14	29	6	9	24	1195		
25	45	15	4	26	7	8	25	1205		
26	47	12	11	23	8	7	26	1215		
27	49	10	1	20	9	6	27	1225		
28	51	7	8	17	10	5	28	1235		
29	53	4	15	14	11	4	29	1246		
30	55	2	5	11	12	3	30	1256		
31	56	15	12	8	13	2	31	1267		
32	58	13	3	5	14	1	32	1278		
33	60	10	9	2	15	..	33	1289		
34	62	8	..				34	1301		

A saturated solution of very pure sugar contains five parts of sugar and three parts of water. This is indicated by 34° of Baume's saccharometer, at the temperature of 82° Fah.

The variation in the proportion of superabundant water is sometimes so considerable, that Dutrone found in the same plantation, at three months' interval, cane-juice, differing from 5° to 14° of the saccharometer. The first contained, according to the table, 9 lbs. 3 oz.; the second 25 lbs. 11 oz. of sugar in 100 lbs. of juice.

Cazaud found that in January, four hundred gallons of juice commonly yielded forty-eight gallons of sugar and molasses, one with the other; in February, from fifty-six to sixty-four; in March, from sixty-four to seventy-two; and in April, sometimes eighty. He affirms, that the dryness of the season, and not the age of the canes, is the cause of this increase of produce: he considers the greatest relative maturity of the canes to be, when the juice is four parts water and one part sugar and molasses. Edwards considers the average proportion to be eight parts water and two sugar and molasses, the latter equally divided.

The juice of canes, just arrived at their full growth, is in the sweet mucous state; this, when clarified and concentrated, assumes a very deep brown colour, and becomes sirop of very thick consistency; if the heat applied be greater than 221° Fah. it will be decomposed; if the juice be expressed from the cane while maturing, the mucous juice is then in the saccharine state, and when clarified and concentrated, produces sirop of a very deep colour and thick consistence; it can scarcely support 225° Fah. without decomposition, while the mucous juice, in the state of essential salt, remains undecomposed at the heat of 260°, and pure sugar will bear exposure to 300°, and even higher, without injury.

It can now be easily perceived, how greatly the presence of sweet and saccharine juices is injurious to the manufacture of sugar, when, as is now always the case, degrees of heat are used sufficiently high to decompose them. The mucilage is more or less abundant according to the nature of the cane and the situation in which it grows; it is the colouring matter of the juice, which varies from lemon colour to a deep brown, according as the heat and alkalis, in separating this matter from the feculencies, increases the proportion of mucilage which is held in solution by the fluids. We have already said that alkalis, combining with the mucilage, give intensity to its colour in proportion to their causticity, and the smell peculiar to the cane is lost in that of leys.

Mineral and acetic acids revive the yellow colour of the juice, and change it to amber, more or less dark, according to their strength. The vegetable acids, such as cream of tartar, citric acid, &c. &c. weaken and partially destroy its colour; oxalic acid destroys it entirely, when the base of this juice, deprived of the colouring principle which held it in solution, shows it under a solid form, white and insoluble in all menstrua. It can readily be conceived that the mucilage, having for its base a substance which is only held in solution by a colouring principle, will injure the crystallization of the sugar in proportion to the quantity of that mucilage which is contained in the expressed juice; whence it may be concluded, that alkalis are injurious in proportion to their activity in separating the mucilage from the feculent parts, and that, in the necessity of employing them to clarify the expressed juice, we should carefully seek for every means of judiciously conducting the operation. This delicate and important office is, however, generally performed in the most slovenly and careless manner.

We next have a description of the general method of manufacturing the juice into sugar, as practised in our colonies, and also of the distillation of rum from the molasses and other matters usually subjected to this process. From the next chapter, which describes at considerable length the French method of manufacturing sugar, as practised by Dutrone, we propose making some extracts.

In speaking of Dutrone he says—After having examined with the greatest care, and in every possible point of view, the means generally in use in his time; after having minutely and profoundly studied the nature of the cane, and acquired the most intimate knowledge of its juice, he discovered and adopted what he considered the most advantageous method for the manufacture of this juice. Many methods seem to have passed in review before him, and many appear to have been rejected before he ultimately fixed his choice. In this selection he was guided, by experience, to the adoption of plans in agreement with the soundest principles of chemistry, and appeals to the result as confirming the propriety of his choice.

In the description about to be given, every operation will be shown perfectly distinct; it will be seen, that each follows the other without confusion, or intermixture; that every step of this method, and the order of its progress, is simple, easy to be understood, and certain in its execution. It will readily be acknowledged, that this progress can be applied to all circumstances under which the juice may be found; that it does not always require the presence of the superintendent; that it may be confided to persons comparatively ignorant, without their being able to derange it, and that all the faults, which are the inevitable effect of negligence, can be repaired with smaller loss than has usually arisen from similar causes.

Dutrone was convinced of the absolute impossibility of entirely removing, by the scummer, the impurities belonging to the juice, and the extraneous earthy matters, which are always in a greater or less proportion found in it; he therefore saw that it was absolutely indispensable to filter, and to leave the cane liquor to deposit before concentrating. For this purpose he adapted two reservoirs, to communicate with the concentrating vessels, which fulfilled this end admirably well, and produced the greatest advantages.

In order that every operation which the manufacture of the juice requires, and the order which it ought to keep, may be easily seen and followed, we will explain the arrangement of the interior of a sugar-house, which Dutrone conceives best qualified for the proper application of this method. All the operations required can be accomplished, either by the assistance of one furnace or two separate ones. In the greatest number of plantations one furnace is preferable, because, while it equally well accomplishes the proposed end, it effects economy of fuel and labour. In very large plantations, where the most powerful means are required, two furnaces should be erected, but it will make no difference in the arrangement of the sugar-house. The vessels used for boiling, are called, collectively, the laboratory, which generally consists of three or four boilers placed in a line. Whatever may be the disposition of the laboratory, the order of the work is the same. The laboratory should be placed in the sugar-house, in such a manner that its two sides and the end, formed by the concentrating pan, should be isolated through the whole extent, in order that the attendance on them may be easy, and that the negroes may be able to execute, with the greatest economy of time and of means, every thing proper to be done for the greatest perfection of the work. The laboratory, in the interior of a sugar-house, has four copper vessels, the capacity of each ought to be from 300 to 600 gallons.* The first, which receives the expressed juice, is called the first clarifier; the next, the second clarifier, the third, the evaporator, the fourth, the concentrator. These vessels are placed very near to each other, and have only an edge of two or three inches thickness between them. The masonry in which they are set forms the sides of the laboratory, the least thickness of which, at the upper part, is about fifteen or eighteen inches. The surface of this masonry is inclined seven or eight inches from the outer edge to the lip of the boilers; there are between each of these, basins let into the masonry, where the scum which is taken off is put, and this is carried back, by channels, to the first clarifier: between this vessel and the wall is a basin, which receives the first feculencies, whence they flow, through a pipe, to a vessel placed underneath to receive them. These basins and channels are made of lead, soldered to a setting of copper, which covers the surface of the masonry of the laboratory; this setting is soldered to the circumference of the boilers, which are also soldered to each other; in this state the laboratory offers the best adaptation to the desired end.

It should be remarked, that in the centre of the basins, which are between the evaporator and the concentrator, there is an opening to a canal, which descends in the thickness of the masonry, and which is then continued horizontally to the bottom of a copper vessel, placed at the foot of the reservoirs for filtration and subsidence. On the surface of the laboratory, on each side of the concentrator, there are canals which proceed from the reservoirs through the brick work, and open near the brim of the boiler. A cooler, placed at the end of the concentrator, forms also part of the laboratory. Two reservoirs, placed at a little distance from the laboratory, serve for filtration and subsidence. The filters ought to be large enough to contain all the expressed juice (diminished to the state of sirop, indicating twenty-four or twenty-six degrees of the saccharometer,) which the mill can furnish in twenty-four hours; they ought to be made of masonry, lined with lead, and entirely covered with several sieves, the bottoms of which may be made with osier hurdles. There are fixed on these bottoms, for the purpose of filtration, first a woollen, then a linen cloth, and lastly a reticulation of brass wire. Two leaden canals form a communication between the reservoirs and the labo-

---

* Their dimensions are—

	Depth.	Diameter. *Top.*	Diameter. *Bottom.*
a - -	27 inches.	88 inches.	64 inches.
b - -	28 "	88 "	64 "
c - -	29 "	80 "	62 "
d - -	30 "	78 "	60 "

Their bottoms are slightly convex.

ratory, the one conveys the evaporated sirop to the vessel placed at the foot of each reservoir, from whence it is poured upon the filters; the other, the opening of which, at the bottom of the reservoir, is shut by a valve, carries back the sirop, filtered and subsided, to the concentrator. The bottom of the reservoir for subsidence, ought to be raised half an inch above the level of the opening of the canal, near the brim of the concentrator. The sugar-house ought to have two laboratories, and each laboratory ought to communicate with the reservoirs.* The reservoirs for the expressed juice are common, or proper, to each laboratory; they are placed outside the sugar-house, as much for cleanliness as for preserving the juice cool; they ought to be covered by a well inclosed shed, or vaulted over. These reservoirs, lined with lead, should each be large enough to contain three hundred and seventy-five gallons, at the least; they ought to be always filled to a fixed and determinate height, equal to one charge,† in order that not only an exact account may be kept of the quantity of expressed juice which comes to the sugar-house, but also of the quantity of lime that should be employed to separate the feculencies from the juice. As it is highly proper to know the degree of richness of the juice to be manufactured, there should be a saccharometer to ascertain it from time to time.

[TO BE CONTINUED.]

The Results of Machinery, namely, Cheap Production and Increased Employment Exhibited; being an Address to the Working Men of the United Kingdom. Forming No. 1 of the Working Man's Companion.

THIS is a work just published by the Society for the Diffusion of Useful Knowledge. We can imagine nothing more suitable to the general mass of readers, and are quite sure that nothing could have been better timed. It is the very thing that was wanted to dispel that great popular delusion which has made the events of the year 1830 an absolute disgrace to us as a civilized and manufacturing people. It is the strong right arm of reason put forth in aid of the comparatively weak arm of the law. In manner and matter it is alike admirable; the style simple and familiar—the reasoning clear—the illustrations copious and well chosen—and the treatment of the subject altogether so satisfactory, that not a shadow of doubt can rest on any willing mind of the soundness of the general conclusion which it is the great purpose of the book to enforce; namely, that to oppose machinery, is to oppose the very best friend the poor, as well as rich, ever had.

---

* It is always better to have two fire places, though only one should be used at a time, lest any accident should happen to the one in use. This precaution is more necessary, since, as the canes cannot be kept without fermenting, all those which were cut would be lost.

† The charge must be a determinate quantity, which ought never to vary when once fixed.

The writer enters on his subject in a manner singularly well calculated to arrest the attention of those classes to whom it is more particularly addressed.

"In the year 1827, a Committee of the House of Commons was appointed to examine into the subject of emigration—that is, to see whether it was desirable and practicable to remove distressed labourers from the United Kingdom to distant places, where their labour might be employed profitably to themselves and others. The first person examined before that committee was Joseph Foster, a working weaver of Glasgow. He told the committee, that he and many others, who had formed themselves into a society, were in great distress; that numbers of them worked at the hand-loom from eighteen to nineteen hours a-day, and that their earnings at the utmost did not amount to more than seven shillings a week, and that sometimes they were as low as four shillings. That twenty years before that time they could readily earn a pound a-week by the same industry; and that as power-loom weaving had increased, the distress of the hand weavers also had increased in the same proportion. A power-loom is one worked by machinery, and not by the hand of man, as most of our readers, perhaps, know. The committee then put to Joseph Foster the following questions, and received the following answers:—

"Q. 'Are the committee to understand that you attribute the insufficiency of your remuneration for your labour to the introduction of machinery?'

"A. 'Yes.'

"Q. 'Do you consider, therefore, that the introduction of machinery is objectionable?'

"A. 'We do not. The weavers in general, of Glasgow and its vicinity, do not consider that machinery can or ought to be stopped, or put down. They know perfectly well that machinery must go on, that it will go on, and that it is impossible to stop it. They are aware that every implement of agriculture or manufacture is a portion of machinery, and, indeed, every thing that goes beyond the teeth and nails, (if I may use the expression,) is a machine. I am authorized, by the majority of our society, to say, that I speak their minds, as well as my own, in stating this.'

"If all, or if a large majority of the working men of our country had come to the same sound opinions as Joseph Foster, we should not take the trouble, because it would be needless, now to address them. But when we hear on all sides that misguided men are violating the laws by which the rights of all are protected; that they are wickedly and ignorantly destroying the property of the farmer and the manufacturer, in the belief that machinery *can* be stopped or put down; that they do *not* know, as the poor weavers of Glasgow *did* know, that machinery must go on, will go on, and that it is impossible to stop it; we think it our duty, having the means of appealing to their reason and to their regard for their own interests, to endeavour to bring their minds to the same conclusions as those of the respectable weaver, whose words we have repeated. He felt that, although he was in his own person a sufferer from the improvement of machinery, it was utterly out of his power, because it was contrary to his reason, and to the reason of all thinking people, whether working men or not, to resist the progress of that improvement. There are many working men who entertain the same sound opinions, which they have come to, probably, by an accurate and dispassionate observation of the facts which are within their own view. To such men we hope to offer many new facts to strengthen their opinions; and we rely greatly upon their influence to point out their errors either to those who are violating the laws, or to those who think the violators of the laws have justice on their side. For the benefit of you all, the informed as well as the uninformed, we address you as men capable of reasoning. We give you a great body of facts to reason upon. We offer nothing to your passions or your prejudices. We shall attempt to make you feel, by bringing before you the same sort of facts by which that sensible man, Joseph Foster, convinced his own mind, that although your individual labour may be partially displaced, or unsettled, for a time, by the use of a cheaper and a better power, which power is machinery, you are great gainers by the general use of that power. We shall strive to show you, that through this power you possess, however poor you may be, many of the comforts which make the difference between man in a civilized and man in a savage state; and further, that, in consequence of machinery having rendered productions of all sorts cheaper, and therefore caused them to be more universally purchased, it has really increased the demand for that manual labour, which it appears to some of you, reasoning only from a few instances, it has a tendency to diminish. If we make out these propositions, we think you will agree with Joseph Foster, that the introduction of machinery is not objectionable."

But, first of all, what is this *machinery* against which such an outcry is raised? There are persons who affect to make a distinction between tools and machines; but the writer shows, with great force and clearness, that the principle of both is precisely the same.

"A tool of the simplest construction is a machine; a machine of the most curious construction is only a complicated tool. There are many cases in the arts, and there may be cases in agriculture, in which the human arm and hand, with or without a tool, may do work that no machine can so well perform. There are processes in polishing, and there is a process in copper-plate printing, in which no substance has been found to stand in the place of the human hand. And if, therefore, the man with a spade alone, does a certain agricultural work more completely than a man guiding a plough, and a team of horses dragging it, (which we do not affirm or deny,) the only reason for this is, that the man with the spade is a better machine than the man with the plough and the horses. The most stupid man that ever existed is, beyond all comparison, a machine more cunningly made by the hands of his Creator, more perfect in all his several parts, and with all his parts more exquisitely adapted to the regulated movement of the whole body, less liable to accidents, and less injured by wear and tear, than the most beautiful machine that ever was, or ever will be, invented. There is no possibility of supplying, in many cases, a substitute for the simplest movements of man's body, by the most complicated movements of the most ingenious machinery. And why so? Because the natural machinery by which a man even lifts his hand to his head is at once so complex and so simple, so apparently easy, and yet so entirely dependant upon the right adjustment of a great many contrary forces, that no automaton, or machine imitating the actions of man, could ever be made to effect this seemingly simple motion, without showing that the contrivance was imperfect—that it was a mere imitation, and a very clumsy one. What an easy thing it appears to be for a farming man to thrash his corn with a flail; and yet what an expensive arrangement of wheels is necessary to produce the same effects with a thrashing machine. The truth is, that the man's arm and the flail form a much more curious machine than the other machine of wheels, which does the same work; and the real question, as regards the value of the two machines, is, which machine in the greater degree lessens the cost of production?

"We state this principle broadly, in our examination into the value of machinery in diminishing the cost of producing human food. A machine is not perfect because it is made of wheels or cylinders, employs the power of the screw or the lever, is driven by wind, or water, or steam, but because it best assists the labour of man, by calling into action some power which he does not possess in himself. If we could imagine a man entirely dispossessed of this power, we should see the feeblest of animal beings. He has no tools which are a part of himself, to build houses like the beaver, or cells like the bee. He has not even learnt from nature to build, instinctively, by certain and unchangeable rules. His power is in his mind; and that mind teaches him to subject all the physical world to his dominion, by availing himself of the forces which nature has spread around him. To act upon material objects, he arms his weakness with tools and with machines. As we have before said, tools and machines are, in principle, the same. When we strike a nail upon the head with a hammer, we avail ourselves of a power which we find in nature—the effect produced by the concussion of two bodies; when we employ a water wheel to beat out a lump of iron with a much larger hammer, we still avail ourselves of the same power. There is no difference in the nature of the instruments, although we call the one a tool, and the other a machine. Neither the tool nor the machine have any force of themselves. In one case the force is in the arm, in the other in the weight of water which turns the wheel."

It is next shown that even tools of the very simplest description are not to be obtained without the aid of machinery.

"All labourers in agriculture know, full well, the value of a tool; but some hate machinery. This is inconsistent. Unless the labourer made a plough, (if he will consent even to a plough,) out of two pieces of stick, and carried it upon his shoulder to the field, as the toil-worn and poor people of India do, he must have some *iron* about it. He cannot get iron *without machinery*. But he hates machinery, and therefore he will have nothing to do with a plough! Will he have his hoe, then? He is not quite sure. Will he give up his knife? No; he must keep his knife. He has got every thing to do for himself, and his knife is his tool of all-work.

"Well, how does he get this same knife? People that have no machinery sharpen a stone, or bit of shell, or bone, and cut or saw with it in the best way they can; and after they have become very clever, they fasten it to a wooden handle with a cord of bark. An Englishman examines two or three dozens of knives, selects which he thinks the best, and pays a shilling for it, the seller thanking him for his custom. The man who has nothing but the bone or the shell would gladly toil a month for that which does not cost an English labourer half a day's wages.

"And how does the Englishman obtain his knife upon such easy terms? From the very same cause that he obtains all his other accommodations cheaper, in comparison with the ordinary wages of labour, than the inhabitant of any other country—that is, from the use of machinery, either in the making of the thing itself, or in procuring that without which it could not be made.

* * * * * *

"Ready made, without the labour of some other man, a knife does not exist; but the iron of which the knife is made, is to be had. Very little iron has ever been found in a native state, or fit for the blacksmith. The little that has been found in that state has been found only very lately; and if human art had not been able to procure any in addition to that, gold would have been cheap as compared with iron.

"Iron is, no doubt, very abundant in nature; but it is always mixed with some other substance that not only renders it unfit for use, but hides its qualities. It is found in the state of what is called iron ore, a stone or earth of some kind or other. Sometimes it is mixed with clay, at other times with lime or flint; and there are cases in which it is so much mixed with sulphur, that it burns like a piece of coal if put in the fire. In short, in the state in which iron is met with, it is a much more likely substance for paving a road, or building a wall, or making mortar, than for making a knife.

"But suppose that the man knows the particular ore or stone that contains the iron, how is he to get it out? Mere force will not do; for the iron and the clay, or other substance, are so nicely mixed, that though the ore were ground to the finest powder, the grinder is no nearer the iron than when he had a lump of a ton weight.

"A man who has a block of wood has a wooden bowl in the heart of it; and he can get it out too by labour. The knife will do it for him in time; and if he take it to the turner, the turner with his machinery, his lathe, and his gouge, will work it out for him in half an hour. The man who has a lump of iron ore has just as certainly a knife in the heart of it; but no mere labour can work it out. Shape it as you may, it is not a knife, or steel, or even iron—it is iron ore;

and dress it as you will, it would not cut better than a brick-bat—certainly not so well as the shell or bone of the savage.

"There must be knowledge before any thing can be done in this case. We must know what is mixed with the iron, and how to separate it. We cannot do it by mere labour, as we can chip away the wood and get out the bowl; and therefore we have recourse to fire."

After describing in an equally popular and instructive style the processes of making cast-iron, bar, or malleable iron, and steel, the author thus sums up the general result.

"Bringing it, (the ore,) into this state, requires great force; and the unaided strength of all the men in Britain could not make all the iron which is at present made, though they did nothing else. Machinery is therefore resorted to; and water-wheels, steam engines, and all sorts of powers are set to work in moving hammers, turning rollers, and drawing rods and wires through holes, till every workman can have the particular form which he wants. If it were not for the machinery that is employed in the manufacture, no man could obtain a spade for less than a year's labour; the yokes of a horse would cost more than the horse himself; and the farmer would have to return to wooden ploughshares, and hoes made of sticks with wooden ends."

* * * * * *

"As iron is with us almost as plentiful as stone, we do not think much about it. But there is a great deal to be done, much thinking and inventing, before so simple a thing as a sixpenny knife could be procured: and without the thinking and the inventing all the strength of all the men that ever lived never could procure it; and without the machinery to lighten the labour, no ingenuity could furnish it at a thousand times the expense."

Another very striking illustration of the influence of machinery in diminishing the cost of production and improving the general condition of men, is drawn from the history of the processes for grinding corn. After mentioning an instance of a New Zealander, who, on returning from a visit to England, carried home with him "a small hand-mill for grinding corn, which he prized as the greatest of all earthly possessions," the writer proceeds:—

"And well might he prize it! He had no machine for converting corn into meal but two stones, such as were used in the remote parts of the Highlands of Scotland some years ago. And to beat the grain into meal by these two stones, (a machine, remember, however imperfect,) would occupy the labour of one-fourth of his family, to procure subsistence for the other three-fourths. The ancient Greeks, three thousand years ago, had improved upon the machinery of the hand-stones, for they had hand-mills. But Homer, the old Greek poet, describes the unhappy condition of the slave who was always employed in using this mill. The groans of the slave were unheeded by those who consumed the produce of his labour; and such was the necessity for meal, that the women were compelled to turn these mills when there were not slaves enough taken in war to perform this irksome office. There was plenty of labour then to be performed, even with the machinery of the hand-mill; but the slaves and the women did not consider that labour was a good in itself, and therefore they bitterly groaned under it. By and bye, the understanding of men found out that water and wind would do the same work that the slaves and the women had done; and that a large quantity of labour was at liberty to be employed for other purposes. You perhaps think that society was in a worse state in consequence. We will tell you exactly in what respects society gains, and what you gain as part of society, by the abolition of hand mills, and the use of wind-mills and water-mills for grinding corn.

"Labour is worth nothing without results. Its value is only to be measured by what it produces. If in a country where hand-mills could be had, the people were to go on beating grain between two stones, you would pronounce them fools, because they could obtain an equal quantity of meal with a much less expenditure of labour. You have perhaps a general prejudice against that sort of machinery which does its work with very little human assistance; it is not quite so certain, therefore, that you would agree that a people would be equal fools to use the hand-mill when they could employ the wind-mill or the water-mill. But we believe you would think, that if flour could drop from heaven, or be had like water by whoever chose to seek it, it would be the height of folly to have stones, or hand-mills, or water-mills, or wind-mills, or any machine whatever for manufacturing flour. Do you ever think of *manufacturing* water? The cost of water is only the cost of the labour which brings it to the place in which it is consumed. Yet this admission overturns all your objections against machinery. *You admit that it is desirable to obtain a thing with no labour at all; can you therefore doubt that it is desirable to obtain it with the least possible labour?* The only difference between no labour and a little labour, is the difference of the cost of production. And the only difference between little labour and much labour is precisely the same. In procuring any thing that administers to his necessities, man makes an exchange of his labour for the thing produced, and the less he gives of his labour, the better of course is his bargain.

"To return to the hand-mill and the water-mill. An ordinary water-mill for grinding corn will grind about thirty-six sacks a-day. To do the same work with a hand-mill would require 150 men. At 2*s*. a-day, the wages of these men would amount to 15*l.* which, reckoning 6 working days, is 90*l.* a week, or 4680*l.* a year. The rent and taxes of a mill would be 150*l.* a year, or ten shillings a working day. The cost of machinery would be certainly more for the hand-mills than the water-mill, therefore we will not take the cost of machinery into the calculation. To produce, therefore, thirty-six sacks of flour by hand, we should pay 15*l*; by the water-mill we should pay ten shillings; that is, we should pay thirty times as much by the one process as by the other, The actual saving is something about one-half of the price of the flour in the market; that is, the consumer, if the corn were ground by hand, would pay double what he pays now that it is ground at a mill. He pays 10*d.* for his quartern loaf now; he would pay 20*d.* then.

"But if the system of grinding corn by hand were a very recent system of society, and the introduction of so great a benefit as the water-mill had all at once displaced the hand-grinders, as the spinning machinery displaced the spinning-wheel, what must become, you say, of the one hundred and fifty men who earned the 15*l.* a-day, of which sum, the consumer has now got 14*l.* 10*s.* in his pocket? They must go to other work. And what is to set them to that work? The same 14*l.* 10*s.* which, being saved in the price of flour, gives the poor man, as well as the rich man, more animal food and fuel; a greater quantity of clothes, and of a better quality; better furniture, and more of it; and, above all, more books. To produce these things there must be more labourers employed than before. The quantity of labour is, therefore, not diminished, while its productiveness is much increased. It is as if every man among us had become suddenly much stronger and more industrious. The machines labour for us, and are yet satisfied without either food or clothing. They increase all our comforts, and they consume none themselves. The hand-mills are not grinding, it is true; but the ships are sailing that bring us foreign produce; the looms are moving that give us more clothes; the potter, and glass-maker, and joiner, are each employed to add to our household goods; we are each of us elevated in the scale of society; and all these things happen because machinery has diminished the cost of production."

(TO BE CONTINUED.)

Preliminary Discourse on the Study of Natural Philosophy. By JOHN FREDERICK WILLIAM HERSCHEL, *Esq. A. M. late Fellow of St. John's College, Cambridge, &c.*

THIS work is calculated to be of great and extensive utility. In an age like the present, in which the means of acquiring knowledge are no longer out of the reach even of the humblest classes of society, it becomes of the utmost importance that the numberless inquiries after the truths of nature should be directed in the right path to the acquisition of the knowledge they desire; and that those who have hitherto neglected the study, from a notion of its dryness or unprofitableness, should be aroused to it by proofs of its amusing and highly useful character. To effect these too objects seems to us to be the principal aim of the author.

The discourse commences most judiciously. General readers are apt to be deterred from the perusal of a book of this nature, from an idea that the subject is necessarily a dull, and, to the uninitiated, an uninteresting one. Aware of this, Mr. Herschel strives, and strives effectually, to invest the introductory portion of his work with as much of popular interest as possible; and, by means of the introduction of numerous apposite illustrations, and of anecdotes, to render it as amusing as any tale, while the reader is unconsciously led on to the portals of scientific inquiry. In this part, too, he takes occasion to refute the common-place objection, that science is of no practical utility. Mr. Herschel exposes its fallacy in the most simple and convincing way, by producing unanswerable instances of the wonderful effects which have been, and are daily, produced by a proper application of the laws of nature, and by showing, that without the knowledge of those laws, man is deprived of the most effectual means of raising himself above the level of the rest of the animal creation. The following extract will show how triumphantly he proves the importance of this knowledge, and, at the same time, will exemplify the remarks we have made above as to the entertaining style of this part of the work; the paragraphs, it will be noticed, are numbered—a very great help to facility of reference.

"35. But if the laws of nature, on the one hand, are invincible opponents, on the other they are irresistible auxiliaries, and it will not be amiss if we regard them in each of these characters, and consider the great importance of a knowledge of them to mankind.

"I. In showing us how to avoid attempting impossibilities.

"II. In securing us from important mistakes in attempting what is in itself possible, by means either inadequate or actually opposed to the end in view.

"III. In enabling us to accomplish our ends in the easiest, shortest, most economical, and most effectual manner.

"IV. In inducing us to attempt, and enabling us to accomplish, objects which but for such knowledge we should never have thought of undertaking.

"We shall, therefore, proceed to illustrate by examples the effect of physical knowledge under each of these heads.

"36. Ex. 1. (35.) I. It is not many years since an attempt was made to establish a colliery at Bexhill, in Sussex. The appearance of thin seams and sheets of fossil-wood and wood-coal, with some other indications similar to what occur in the neighbourhood of the great coal beds in the north of England, having led to the sinking of a shaft and the erection of machinery, on a scale of vast expense, not less that £80,000 are said to have been laid out on this project, which, it is almost needless to add, proved completely abortive, as every geologist would have at once declared it must, the whole assemblage of geological facts being adverse to the existence of a regular coal-bed *in* the Hastings *sand;* while this, on which Bexhill is situated, is separated from the *coal strata* by a series of interposed beds of such enormous thickness as to render all idea of penetrating *through* them absurd. The history of mining operations is full of similar cases, where a very moderate acquaintance with the usual *order of nature*, to say nothing of theoretical views, would have saved many a sanguine adventurer from utter ruin.

"37. Ex. 2. (35.) II. The smelting of iron requires the application of the most violent heat that can be raised, and is commonly performed in tall furnaces, urged by great iron bellows driven by steam engines. Instead of employing this power to force *air* into the furnace, through the intervention of bellows, it was on one occasion attempted to employ the steam itself in apparently a much less circuitous manner, viz. by directing the current of steam in a violent blast from the boiler at once into the fire. From one of the known ingredients of steam being a highly inflammable body, and the other that essential part of the air which supports combustion, it was imagined that this would have the effect of increasing the fire to tenfold fury, whereas it simply *blew it out:* a result which a slight consideration of the laws of chemical combination, and the state in which the ingredient elements exist in steam, would have enabled any one to predict without a trial."—p. 44.

Well would it have been for many an ingenious projector if he had paused in the prosecution of a favourite scheme, until he had inquired whether its success might not be incompatible with the unalterable laws which regulate the economy of the universe. Many unfortunate instances have not been wanting in which suicide has been the termination of a career of attempted discovery, a result which might have been avoided, in most cases, by merely a slight devotion to the study of natural philosophy. The melancholy end of a schemer of this description, who perished, (unintentionally,) by his own act, and in the very moment of anticipated triumph, is thus related in the volume before us:—

"38. Ex. 3. (35.) II. After the invention of the diving-bell, and its success in subaqueous processes, it was considered highly desirable to devise some means of remaining for any length of time under water, and rising at pleasure without assistance, so as either to examine at leisure the bottom, or perform at ease any work that might be required. Some years ago an ingenious individual proposed a project by which this end was to be accomplished. It consisted in sinking the hull of a ship made quite water-tight, with the decks and sides strongly supported by shores, and the only entry secured by a stout trap-door in such a manner that by disengaging from within the weights required to support it, it might rise of itself to the surface. To render the trial more satisfactory, and the result more striking, the projector himself made the first essay. It was agreed that he should sink in twenty fathoms water, and rise again without assistance at the expiration of 24 hours. Accordingly, making all secure, fastening down his trap-door, and provided with all necessaries as well as with the means of making signals to indicate his situation, this unhappy victim of his own ingenuity entered and was sunk. No signal was made, and the time appointed elapsed. An immense concourse of people had assembled to witness his rising, but in vain, for the vessel was never seen more. The pressure of water at so great a depth had, no doubt, been completely under estimated, and the sides of the vessel being at once crushed in, the unfortunate projector perished before he could even make the signal concerted to indicate his distress."

These examples might be enough to prove his proposition, but our author with a lavish hand, makes his position doubly strong by a few more modern instances. We have already quoted rather largely from them, but we cannot resist the temptation of giving the following, it is so completely and directly to the point:—

"39. Ex. 4. (35.) III. In the granite quarries near Seringapatam the most enormous blocks are separated from the solid rock by the following neat and simple process:—The workman having found a portion of the rock sufficiently extensive and situated near the edge of the part already quarried, lays bare the upper surface and marks on it a line in the direction of the intended separation, along which a groove is cut with a chisel about a couple of inches in depth. Above this groove a narrow line of fire is then kindled, and maintained till the rock below is thoroughly heated, immediately on which a line of men and women, each provided with a pot full of cold water, suddenly sweep off the ashes, and pour the water into the heated groove, when the rock at once splits with a clean fracture. Square blocks of 6 feet in the side and upwards of 80 feet in length,* are sometimes detached by this method, or by another equally simple and efficacious, but not easily explained without entering into particulars of mineralogical detail."

Mr. Herschel winds up this branch of the subject with the following just observation:—

"41. Ex. 6. (35.) III. To accomplish our ends quickly is often of at least as much importance as to accomplish them with little labour and expense. There are innumerable processes which, if left to themselves, *i. e.* to the ordinary operation of natural causes, are done, and well done, but with extreme slowness; and in such cases it is often of the highest practical importance to accelerate them. The bleaching of linen, for instance, performed in the natural way by exposure to the sun, rain, and wind, requires many weeks or even months for its completion; whereas by the simple immersion of the cloth in a liquid, chemically prepared, the same effect is produced in a few hours. The whole circle of the arts, indeed, is nothing but one continued comment upon this head of our subject. The instances above given are selected, not on account of their superior importance, but for the simplicity and *directness* of application of the principles on which they depend, to the objects intended to be attained."—p. 49.

One class of objectors thus satisfactorily disposed of, Mr. Herschel shortly after takes occasion, incidentally, to combat the opinions of another—those who admit the benefit of scientific knowledge, but, at the same time, contend that it should not be extended to the many. Mr. Herschel is, as we have observed, one of the most brilliant living luminaries of the world of science—he has been acknowledged worthy of becoming the head of one of our most learned, and perhaps, at the same time, one of our most aristocratic societies. His opinion, therefore, on the subject of the expediency of preserving a monopoly of knowledge, cannot be uninteresting:—

"63. Knowledge can neither be adequately cultivated nor adequately enjoyed by a few; and, although the conditions of our existence on earth may be such as to preclude an abundant supply of the physical necessities of all who may be born, there is no such law of nature in force against that of our moral and intellectual wants. Knowledge is not, like food, destroyed by use, but rather augmented and perfected. * * * * Those who admire knowledge for its own sake, ought to wish to see its elements made accessible to all, were it only that they may be the more thoroughly examined into, and more effectually developed in their consequences, and receive that ductility and plastic quality which the pressure of minds of all descriptions, constantly moulding them to their purposes, can alone bestow.—"p. 69.

---

* Such a block would weigh between 4 and 500,000 lbs.

What can be more conclusive than this? What greater triumph for the advocates of the diffusion of scientific knowledge among the humbler classes of the people, for the promoters of those institutions whose establishment may not unlikely create a new era in the history of arts and sciences? The question of their utility, (if question it ever was,) is now settled—for Mr. Herschel's arguments cannot be easily invalidated.

Perhaps we have lingered too long on the first division of this Preliminary Discourse—if so, the fascinating nature of its contents must plead our excuse. To be more methodical, our author divides his subject into three parts.

"Part I.—Of the general nature and advantages of the study of the physical sciences."

"Part II.—Of the principles on which physical science relies for its successful prosecution, and the rules by which a systematic examination of nature should be conducted."

"Part III. Of the subdivision of physics into distinct branches and their mutual relations."

"Of the first division we have already given some account; besides, however, developing the importance of physical science, combatting the objections of the opponents to its diffusion, and inciting the undetermined or the indifferent to its study, it contains a masterly sketch of the various motive-forces in nature, at the conclusion of which the enlightened author pays the following gratifying tribute to the importance of practical mechanics.

"58. Such are the forces which nature lends us for the accomplishment of our purposes, and which it is the province of practical mechanics to teach us to combine and apply in the most advantageous manner; without which the mere command of power would amount to nothing. Practical mechanics is, in the most pre-eminent sense, a *scientific art;* and it may be truly asserted, that almost all the great combinations of modern mechanism, and many of its refinements and nicer improvements, are creations of pure intellect, grounding its exertions upon a moderate number of very elementary propositions in theoretical mechanics and geometry. On this head we might dwell long, and find ample matter, both for reflection and wonder, but it would require not volumes merely, but libraries, to enumerate and describe the prodigies of ingenuity which have been lavished on every thing connected with machinery and engineering." —p. 63.

Part II. consists chiefly of a demonstration of the advantages of the inductive system in the pursuit of philosophical truth, with illustrations of its wonderful success in many instances in leading to the discovery of the secrets of nature, and examples of the method of applying the process. The following rules for the observation of natural phenomena may give an idea of the clearness and conciseness of this part.

"145. When we would lay down general rules for guiding and facilitating our search among a great mass of assembled facts, for their common cause, we must have regard to the characters of that relation which we intend by cause and effect. Now these are,

"1st. Invariable connexion, and, in particular, invariable antecedence of the cause and consequence of the effect, unless prevented by some counteracting cause. But it must be observed, that in a great number of natural phenomena, the effect is produced gradually, while the cause goes on increasing in intensity, so that the antecedence of the one, and the consequence of the other, becomes difficult to trace, though it really exists. On the other hand, the effect often follows the cause so instantaneously, that the interval cannot be perceived. In consequence of this, it is sometimes difficult to decide of two phenomena constantly accompanying one another, which is the cause or which the effect."

"2nd. Invariable negation of the effect with absence of the cause, unless some other cause be capable of producing the same effect."

"3d. Increase or diminution of the effect, with the increased or diminished intensity of the cause, in cases which admit of increase and diminution."

"4. Proportionality of the effect to its cause in all cases of *direct unimpeded* action."

"5th. Reversal of the effect with that of the cause."

In the course of illustrating these and other rules, Mr. Herschel again displays his talent for agreeable and pertinent anecdote; for instance, in cautioning against the prejudices of the senses—fatal obstacles in the pursuit of truth—he proceeds thus:—

"72. To give one or two more examples of the kind of illusion which the senses practise on us, or rather, which we practise on ourselves, by a misinterpretation of their evidence; the moon at its rising and sitting appears much larger than when high up in the sky. This is, however, a mere erroneous judgment; for when we come to measure its diameter, so far from finding our conclusion borne out by fact, we actually find it to measure materially less. Here is eyesight opposed to eye-sight, with the advantage of deliberate measurement. In ventriloquism we have the hearing at variance with all the other senses, and especially with the sight, which is sometimes contradicted by it in a very extraordinary and surprising manner, as when the voice is made to seem to issue from an inanimate and motionless object. If we plunge our hands, one into ice-cold water, and the other into water as hot as it can be borne, and, after letting them stay in awhile, suddenly transfer them to a vessel full of water at a blood-heat, the one will feel a sensation of heat, the other of cold. And if we cross the two first fingers of one hand, and place a pea in the fork between them, moving and rolling it about on a table, we shall, (especially if we close our eyes,) be fully persuaded we have two peas. If the nose be held while we are eating cinnamon, we shall perceive no difference between its flavour and that of a deal shaving."—p. 82.

Here felicity of illustration is perhaps carried to its utmost extent, and one beauty of the instances, or most of them, is, that they are so simple, as to admit of being put in practice by any one with hardly any preparation.

In the third part, each science is considered separately; its characteristics are given, with a brief outline of its history. Of these, the most space is devoted to astronomy, chemistry, and electricity, on the wonders of the latter of which sciences, our author seems to dwell with the greatest satisfaction. The information he gives on each subject is very extensive, when the size of the book is taken into consideration; and, at the same time that it is, in one sense, satisfactory, it leaves the reader still so unsatisfied as to desire further information, and, consequently, to go further than this Preliminary Discourse can be expected to carry him—an effect which the writers of elementary works should always endeavour to produce, although few can expect to succeed in the same degree as Mr. Herschel.

Throughout the work, the astonishing progress made in every department of physical science, within the last few years, is so strikingly displayed, that the author is very appropriately led to conclude with a sketch of the causes which have led to this advance. One of the most important of these is thus noticed:—

"284. The telescope, as it exists at present, with the improvements in its structure and execution which modern artists have effected, must assuredly be ranked amongst the highest and most refined productions of human art; that in which man has been able to approximate more closely to the workmanship of nature, and which has conferred upon him, if not another sense, at least an exaltation of one already possessed by him that merits almost to be regarded as a new one. Nor does it appear yet to have reached its ultimate perfection; to which, indeed, it is difficult to assign any bounds, when we take into consideration the wonderful progress which workmanship of every kind is making, and the delicacy, far superior to that of former times, with which materials may now be wrought, as well as the ingenious inventions and combinations which every year is bringing forth for accomplishing the same ends by means hitherto unattempted."—p. 256.

It is pleasing to see a man of learning thus liberally acknowledging the obligations of philosophy to the mechanical arts. It is certain that without them astronomy could not possibly have taken the rapid strides it has made within the last half century.

We conclude by heartily recommending the work under review to our readers; we shall be surprised if by its means many, who are now insensible to the charms of philosophic research, shall not join the ranks of science; if many, whose names are destined to become enrolled in the lists of fame as diligent observers of the natural world, or furtherers of the discovery of physical truth, shall not date their resolution of attempting to penetrate the mysteries of nature from their perusal of Herschel's Preliminary Discourse on the Study of Natural Philosophy. [*Mechanics' Magazine.*

On the Mode of Ascertaining the Commercial Value of Ores of Manganese. By Edward Turner, *M.D., F.R.S.L. and E., Sec. G.S. Professor of Chemistry in the University of London.*

The analysis of the ores of manganese, when pure, is exceedingly simple. The operator need only, by well known methods, determine the water which the ore contains, and the oxygen which it loses in being converted into the red oxide. Its degree of oxidation, on which the commercial value of ores of manganese so essentially depends, may then be readily inferred.

But when impurities prevail, as they almost always do, more or less in commercial manganese, the analytic process is complex and troublesome; and the presence of iron, which is rarely absent, renders an exact result by the ordinary modes of analysis almost impracticable. For, as I have elsewhere stated,* when peroxide of iron is strongly heated in mixture with peroxide or deutoxide of manganese, oxygen is given out by the former as well as by the latter; and, accordingly, the oxygen lost by heat ceases to indicate the nature of the manganese. A moderately correct allowance for the quantity of oxygen emitted by the iron under these circumstances would be difficult, even after ascertaining in the moist way the quantity of iron contained in the ore; since the constitution of the resulting oxide of iron, as well as its uniformity, is probably variable, and, at all events, is undetermined. The chemist would, therefore, have to ascertain separately each constituent of the ore, and consider the loss as oxygen belonging to the manganese,—a method not to be trusted in a complicated analysis, and which would be wholly inapplicable if the iron, as contained in the ore, should happen not to be uniformly oxidized.

I was led to reflect on these difficulties in consequence of being requested, some months ago, to examine a considerable number of different ores of manganese, the object being solely to ascertain the relative quantities of chlorine which an equal weight of each ore was capable of supplying; and as the method to which I had recourse gives such information with rapidity and precision, I have drawn up a short description of the process; not from any novelty being attached to it, but in the belief that it may be useful to persons engaged in a similar inquiry.

The method, in principle, consists in dissolving a given weight of the ore in muriatic acid, condensing the chlorine in water, and, by some uniform measure, estimating the quantity of chlorine relatively to an equal weight of pure peroxide of manganese, selected as a standard of comparison. The substance first used with this intention was a solution of indigo; but a weak solution of green vitriol, employed by Mr. Dalton for ascertaining the strength of bleaching powder, was found to be more precise in its indications.

---

* Brewster's Journal of Science, N. S. ii. 213.

The method of manipulating is as follows:—About ten grains of the ore in fine powder is introduced into a flask capable of containing about an ounce of water, and into its neck is fitted, by grinding, a bent tube about two inches long, which conducts the chlorine from the flask into a tube about sixteen inches in length, and five-eighths of an inch wide, full of water, and inverted in a small evaporating capsule, employed as a pneumatic trough. The apparatus being adjusted, the flask is half filled with concentrated muriatic acid, the conducting tube instantly inserted, and heat applied by means of a spirit-lamp. The air of the flask, together with the chlorine, is then collected, the greater part of the latter, if the gas is not very rapidly disengaged, being absorbed in its passage; and, consequently, the receiving tube, at the close of the process, will be about half full of gas. When the ore is completely dissolved, the last traces of the chlorine are expelled from the flask by muriatic acid gas. In order that the chlorine thus collected may be entirely absorbed, the aperture is closed by a ground stopper, or, still more conveniently, with the finger, and the gas is well agitated until the chlorine is wholly absorbed. As the solution in the inverted tube may become too much saturated to dissolve all the chlorine, it is convenient to fill a pipette with pure water, and, with the aid of the mouth, force a current to ascend into the tube, and thereby cause the heavier solution to flow out into the capsule.

The absorption being complete, the solution of chlorine is introduced into a six or eight ounce stoppered bottle, and a dilute solution of green vitriol, made, for example, with a hundred grains of the crystallized salt and a pint of water, is added in successive small quantities until the odour of chlorine just ceases to be perceptible. The quantity of liquid required for the purpose may be conveniently measured in a tube about sixteen inches long, and three-quarters of an inch in diameter, divided into two hundred parts of equal capacity, and supplied with a lip, so that a liquid may be poured from it, without being spilled. In conducting this part of the process, the operator will perceive two odours:—at first, the characteristic odour of chlorine, accompanied with the peculiar irritation of that gas;—and, subsequently, an agreeable, somewhat aromatic odour, unattended with the slightest irritation. The object is, to add exactly so much solution of iron as suffices to destroy the former of these odours, without attempting to remove the latter; a point which, with a little practice, may be readily attained. The whole of the iron is thus brought into the state of peroxide.

The first trial is generally accompanied with some loss of chlorine, and should only be used as a guide to a second and more precise experiment. Accordingly, a weighed portion of the same ore is dissolved, and the chlorine collected as before, except that the solution of green vitriol, in quantity rather less than sufficient, is at once introduced into the inverted tube and capsule. A more ready and perfect absorption of the chlorine is thus effected, and the subsequent addition of a small quantity of sulphate of iron suffices for completing the process.

The principal sources of error in this method are the two following:—loss of chlorine, by smelling repeatedly, and exposure to the air when the gas is absorbed by pure water; and oxidation by the air when the absorption is made directly by means of the solution of iron. The small flask and inverted tube are apt to retain the odour of chlorine, and should therefore be rinsed out with the absorbing liquid. It should be remembered, also, that a given quantity of chlorine will emit a more or less distinct odour, according as it is less or more diluted. But by operating always in the same manner, and employing such weights of different ores, that equal quantities of the solution may contain nearly equal quantities of chlorine, it is easy to be independent of these errors of manipulation, by causing them to affect each experiment to the same degree. It will accordingly be found, with a little practice, that results of surprising uniformity may be thus obtained; and even the constitution of pure oxides of manganese may be ascertained by this method, almost with the same accuracy as by directly determining the quantity of oxygen. [*Jour. Royal Institution.*

Bent Axle and Dished Wheels.

Extract from an Essay "on the Construction of Wheel Carriages," by J. S. Fry, Bristol, Eng.

"I know no prejudice more firmly rooted than that in favour of dishing or conical wheels. Much has been written, and well written, to show, and to prove, the absurdity of the use of them, but hitherto with very little effect. I think the principles, and the effects of them, may be stated in very few words.

"Carriages are intended to travel straight forward: they ought, therefore, to be furnished with wheels, the natural tendency of which should be to go straight forward. The same with a garden-roller; suppose any man was to have a garden or a field-roller, made six inches less in diameter at one end than the other; what would not even the wheel-wrights say of such a man? Yet such an act would be a counterpart of their own, when they recommend broad conical wheels. The natural course of a rolling cylinder is a straight line; and the natural course of a rolling cone is a circle. Let us reverse their natural courses—that is, let us make a cylinder travel in a circle, and a cone in a straight line. It must be obvious that, when each of these bodies is forced to travel contrary to nature, in the course of the other, there must be a constant dragging, or twist, on the ground, to keep it in its unnatural course. Such would be the case if a man was to drag a common garden-roller round in a small circle; and such, too, would be the case, if a man was to drag straight forward a garden-roller, made six inches less in diameter at one end than at the other. The effect in both cases would be precisely the same. Each operation would be attended with prodigious labour; and the roller, in each case, by its twist on the ground, would break up and derange the gravel beneath. Now it is well known that the machine constantly in use, in numberless manufactories, as the best that has hitherto been invented for expeditiously and effectually grinding to powder the hardest and toughest materials, is a cylinder forced round in a circle. Therefore, as a cylinder moving in a circle is the best machine that the ingenuity of man has hitherto produced for pulverizing the hardest and toughest materials, and as this is effected by the twist or drag produced between the edge of the cylinder and the surface on which it rolls, and as the twist or drag is precisely the same in the case of a cone forced straight forward, I think I may be borne out in my opinion, that a heavy wagon, with broad conical wheels, is the most complete, the most efficacious machine that the art of man, in the present state of science, could construct for grinding to powder the materials of our roads.*

"And it is also true that, as the wheel grinds the road, in that proportion does the road grind the wheel. The tire of cylindrical wheels, therefore, would last probably many times as long as that of conical wheels.

"It appearing, then, that the cylindrical wheel only has a natural tendency to roll straight forward, all carriage wheels ought to be so constructed. Consequently, the ends of *the axles ought not to be conical, or tapered, nor bent down*, as they are now made; but the axle ought to be put into a lathe, and both ends turned, like the two ends of a spindle for mill work, cylindrical: that is to say, of the same size, or diameter, at the ends as they are at the shoulders; and, of course, the boxes in the wheels should be cylindrical also.

"It should be known that wheels of this construction are liable to only three-fourths of the usual toll, by the 55th Geo. III. chap. 119, at the discretion of the trustees.

"It being shown above that the conical wheels of broad-wheel wagons are the same in operation and effect, on the materials of the roads, as drug-mills, it follows, of course, that all that portion of labour which is applied to the conical wheel, to keep it in a straight course, more than would be required to impel it in its natural circle, is so much power not merely wasted, but most mischievously and most effectually applied in grinding the materials of the road into powder; and as these wagons weigh, in summer, eight tons each, the silent mischief effected by these four drug-mills, of two tons weight each, is great beyond calculation. How much power is thus misapplied may be conceived, as it frequently requires ten of the heaviest horses to draw it—which is just sixteen hundred weight each; a weight sometimes drawn by light horses, in stage-coaches, and at least at three times the pace." [*Mechanics' Magazine.*

---

* On looking over the Essay on Wheel Carriages, published in the year 1813, by Richard Lovell Edgeworth, I find the same comparison in illustration of the effects of broad conical wheels. But as the above is copied from my own manuscript, written twenty years ago, I hope not to incur the charge of plagiarism.

To restore the Elasticity of Damaged Feathers.

A feather, when damaged by crumpling, may be perfectly restored by the simple expedient of immersing it in hot water. The feather will thus completely recover its former elasticity, and look as well as it ever did. This fact was accidentally discovered by an amateur ornithologist of Manchester. Receiving, on one occasion, a case of South American birds, he found that the rarest specimen it contained was spoilt, from having had its tail rumpled in the packing. Whilst lamenting over this mishap, he let the bird fall from his hands into his coffee cup; he now deemed it completely lost, but, to his agreeable surprise, he found, that after he had laid it by the fire to dry, the plumage of the tail became straight and unruffled, and a valuable specimen was added to his collection.

[*Jour. Royal Institution.*

Meteorological Observations for April, 1831.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain and snow.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2, P. M.	Direction.	Force.		
				Inches	Inches.			Inches.	
	1	48°	59°	29.70	29.80	West.	Moderate.		Clear day.
	2	41	64	.95	.95	SW. S.	do.		Clear day.
	3	44	68	.80	.90	SE. SE.	do.		Clear.—Overcast.
	4	47	51	.80	.80	S. SE.	do.	·45	Rain drizzle--foggy-rain.
☾	5	45	51	.55	.85	W. NW.	do.		Cl'dy-cl'r [thun. & light.
	6	37	63	30.10	30.10	W. SW.	do.		White frost—clear.
	7	45	67	25.95	29.90	SW. S.	do.		Clear day.
	8	51	68	29.80	.55	South.	Blustering.	.15	Clear—cloudy—rain.
	9	37	44	.20	.40	W. NW.	do.		Flying cl'ds—snow squall.
	10	32	53	.70	.60	W. SW.	do.	.08	Clear—flying cl'ds—rain.
	11	45	50	.50	.50	SW. W.	do.		Cloudy day.
⊗	12	31	41	.76	.85	W. NW.	do.		Clear day.
	13	33	60	30.00	30.00	W. SW.	Moderate.		White frost—clear
	14	40	68	29.96	29.93	SW.	do.		Clear—overcast.
	15	54	62	.80	.90	South.	do.		Rain—cloudy.
	16	55	58	.80	.75	S. E.	do.	2.48	Rainy day.
	17	54	70	.88	.80	NE. NW.	do.		Cloudy—flying clouds.
	18	52	72	.85	.85	NW. W.	do.		Clear day.
☽	19	54	71	.75	.75	West.	do.		Cloudy—brilliant aurora
	20	52	74	.75	.70	S. W.	Blustering.		Cloudy—clear [borealis.
	21	51	60	.76	.80	NE. W.	Moderate.	.03	Cl'dy day—rain in night.
	22	46	64	.70	.70	S. E.	do.	.24	Cl'dy day—thun. shower.
	23	44	55	.70	.70	S. E.	do.	.10	Cloudy—rain in night.
	24	44	54	.70	.70	West.	do.		Clear—flying clouds.
	25	45	64	.63	.60	W. NE.	do.		Flying clouds.
🌝	26	46	61	.64	.73	East.	do.		Cloudy day.
	27	45	54	.80	.80	N. E.	Blustering.		Cloudy day.
	28	40	43	.50	.50	East.	do.	2.00	Rainy day.
	29	38	51	.33	.35	West.	do.	.05	Rain—cloudy.
	30	45	56	.40	.40	do.	do.		Cloudy day.
	Mean	44.70	59.20	29.72	29.73			5.58	In. of rain in the month.

	Thermometer.	Barometer.
Maximum height during the month,	74. on the 20th	30.10 on the 6th.
Minimum do. . . .	31. on the 12th, . . .	29.20 on the 9th.
Mean do.	51.95	29.725

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JUNE, 1831.

On the Importance of Hygrometric Observations in Meteorology, and on the means of Making them with accuracy.

[Continued from page 229.]

On the 1st of April last, I hung up in the open air, two unglazed porous earthen pots, one in the sun, and the other in the shade, having first filled them with water.

The water which was used in filling up these pots every day, as it disappeared by evaporation, was supplied from bottles containing a known quantity, and at the end of the month, which was an uncommonly wet one, 37 oz. avoirdupois had been expended from the bottle supplying the pot in the shade, and 49 oz. from the other.

By calculating the number of square inches of surface which these earthen pots exposed to the air, (they are globes of 9¾ inches in diameter,) it appears that one inch and eighty-three-hundredths evaporated from the one in the shade, and 2¼ inches from the one in the sun. Calculating according to this latter rate, it will be found that 273 cubic feet of water are evaporated per day, at an average, from an acre of humid surface exposed to the sun: or allowing eight pounds to the gallon—2129 gallons per day, through the month of April—and this is probably about the quantity evaporated from 160 square perches of canal.

I am now carrying on a set of experiments which will test the evaporation from canals with more certainty. The quantity evaporated, however, must be much greater during the summer months.

I have constantly used the water in the porous pot kept in the shade to ascertain the evaporating point, which was explained in the last number of this journal, and I do not yet despair of discovering a method of ascertaining the dew point, from the temperature of the air and the evaporating point alone.

My observations, since my last communication on this subject, will warrant me in saying that, when the temperature of the air is from 60° to 62°, the evaporating point is just half way between the temperature of the air and the temperature of the dew point—and that when the temperature of the air rises above this, the evaporating point is nearer the dew point; and when the temperature of the air sinks below 60°, the evaporating point recedes from the dew point. The exact ratio I have not determined. I have also had the pleasure of witnessing the fall of the dew point previous to every rain which took place during the month of April—and I now consider a sudden fall of the dew point, (unless this fall depends upon a change of wind,) a strong symptom of rain, especially if previous to the fall it stands above the mean of the month. The mean of the dew point for the month of April is 40.9—and for the temperature of the air, about 13 degrees higher, or 54°. For the first seven days of May, the mean of the thermometer was 56.6°, and the mean of the dew point 44.3°. A difference of 12.3 degrees.

In August, 1828, from the 9th till the 19th, the mean of the thermometer was 75 degrees, and the mean dew point 63. A difference of 12 degrees—the dew point ranging from 75° to 51°. During the remainder of the month, the dew point ranged from 72° to 42°, and the thermometer from 94° to 46°, which brings the mean dew point 13 degrees below the mean temperature of the air. This difference is just double what it is asserted to be in Great Britain, (see art. Hygrometry, Edinburgh Encyclopedia.) For there the difference at a mean between the temperature of the air and the dew point, is said to be between 6 and 7 degrees. Hence it will follow that evaporation is much greater here, particularly in the summer months, than it is in Great Britain. Greater, not only on account of the higher temperature, but on account of the greater depression of the dew point below the temperature of the air. It is highly important that this subject should be attended to in the United States. The greatest difference I ever observed, in the summer, though I presume it is sometimes more, was on the 30th August, 1828, two days after a very great rain—the dew point being 54°, and the temperature of the air 84°, at 12 o'clock. The greatest difference of last month was on the 20th, just before a great rain—the dew point being 41°, and the air 74°—amounting to 33 degrees.

The mean of 23 observations taken about sunrise during the month of April, makes the mean minimum temperature 47.3°, that is 7.3° above the mean dew point.

Now, the writer of the article, Hygrometry, referred to above, says, "The mean point of deposition, [dew point,] must be nearly the same as the minimum temperature of any place on a given day." Again he says, "it appears from a meteorological journal kept by the Rev. Mr. Gordon, that the minimum temperature of Perth, and *consequently*, the mean point of deposition for that place, is about 6 degrees below the mean temperature, thus coinciding very nearly with the result formerly deduced from theory as the mean point of deposition for Great Britain, and the globe in general." Now my observations clearly prove the incorrectness of these theoretical views, and, of course, of all the calculations founded on them. It is true, on all nights in which there is dew, the bodies on which dew is deposited, must have been cooled down by radiation below the dew point; but even then, the temperature of the air 10 feet above the surface of the ground, may be, and frequently is, 6 or 8 degrees higher—and in all nights in which dew is not deposited, the minimum temperature must necessarily be above the dew point. In fact, nothing can be more fallacious than theory on the subject of meteorology: what theorist would have anticipated a fall of the dew point before rain? Nature must be interrogated, and she will give faithful responses.

I think it probably will be discovered, that the mean dew point for a month, is as far below the minimum temperature as the mean minimum is below the mean temperature—and if so, the mean dew point, the mean minimum, the mean temperature, and the mean maximum, will form an arithmetical progression. Such was the fact during the month of April—the common difference being 6½ degrees, very nearly.

The discovery of this one fact, the falling of the dew point previous to rain, I consider of immense importance in the science of meteorology. It will lead, I trust, not only to the prediction of rain, but to the explanation of many other phenomena, never yet explained. For example, on the 19th of April, about 9 o'clock, a most brilliant Aurora Borealis appeared for a short time; on the same evening, at 6 o'clock, the dew point was taken, and found to be what it had been for several days before, 55°. At half past 8 it was taken again, and found to be 45°, that is, in a very short time, it had fallen 10 degrees. Now that these two things were connected together, as cause and effect, is highly probable. Let observations be multiplied on this subject. The dew point, however, did not stop here; it continued to fall, till the 22nd, when at 6 o'clock, P. M. it was down to 35, and shortly after this, it began to rain.

It is proper to mention here that the porous pot does not give the true evaporating point, when there is a sudden change in the dew point, because it cannot instantly assume the corresponding temperature. Indeed once during the month of April, when there had been a very sudden rise in the dew point, the evaporating point, as taken by the pot, was below the dew point. A skilful observer will be aware of this, and guard against it. I might mention here that the temperature of the water in the pot was once observed to be 2¼ degrees below the freezing point; and although the water was agitated by dipping the bulb of the thermometer into it, it did not freeze.

If these observations should meet the eye of the writer of the article, "Hygrometry," mentioned above, I hope he will be induced to observe with greater care whether the mean dew point is really 6 degrees of Fah. below the mean temperature of the air in Europe; for as it is at least double that quantity in this country, and as his theory is undoubtedly wrong in making the mean dew point the same as the mean minimum temperature, I greatly suspect, that upon further investigation, it will be found, that the dew point has been estimated by this writer, too high. In countries where there are heavy dews every night, the mean dew point may approach very near to the mean minimum temperature of the air; but even there the latter temperature must always be a little above the former.

If any gentleman in this country has made observations on the dew point, this most interesting department of meteorology, he will confer a great favour on the public, and particularly on the writer of this article, by communicating the results to the editor of this journal.

From a meteorological journal kept by Mr. E. M'Pherson, at the corner of Chesnut and Broad streets, 45 feet above the level of the sea, it appears that the mean of 22 observations of the barometer, at 9 o'clock, A. M. is 30.026 inches, and the mean of the same number at 5, P. M. is 29.968; the former being nearly six-hundredths greater than the latter: which is in perfect accordance with the theory proposed in my last communication.

I will endeavour to furnish you with observations from Mr. E. M'Pherson's Journal for the month of May, on the dew point, and the evaporating point, with the cotemporaneous temperature of the air;—and if such lines should hereafter be incorporated with the table furnished by your correspondent in Germantown; and an additional line should be added, stating whether there is dew or not—and if, under the head of General Remarks, be added every remarkable phenomenon—particularly how much the dew point falls before it begins to rain—and how much it falls without raining—whether a sudden fall of the dew point is attended with a sudden fall in the temperature of the air,—and *vice versa*—and whether these phenomena do not sometimes occur without any apparent cause from the change in the wind—at what time great rains commence and terminate, and, occasionally, how many degrees a thermometer in the sun rises above one in the shade—and how much colder one is, after dark, exposed on the grass to the open sky, than one not so exposed: then will my wishes on this subject be gratified.

Philadelphia, May 10*th*, 1831.

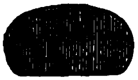
On Sharpening Razors by Burnishing.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—In the Journal of the Franklin Institute, Vol. 7, No. 1, for January, 1831, you have given an account of an instrument and process for sharpening razors, &c. By Thomas Andrew Knight, Esq.

I have had the same thing in contemplation for more than seven years, but through disappointment by the instrument maker, have never brought it to perfection. You were acquainted with my first essays on this subject.

From subsequent experiments, I am fully satisfied that the instrument should be made, not to cut or abrade, but to give a fine edge to the razor by burnishing only; it, therefore, should be made of the finest cast steel, as hard, and polished as highly, as possible; and in the using, it is only necessary to smear it over with a little sweet oil, as a medium to prevent the edge of the razor from coming into too close a contact with the burnisher, and so prevent abrasion. By this procedure I give my razor a highly polished, and an exquisitely smooth edge; and by thus burnishing the edge it is made hard and durable. In other respects it should be used according to the directions of Mr. Knight, to which I refer.



My Burnisher, (exclusive of its handle,) is about 4½ inches long, of an oval figure, with one side flat, like the annexed sectional drawing. The advantages of which are, that the flat side may be used for a soft razor, the broad round side for a harder, and the narrow edges for the hardest: by thus proportioning the surface of the burnisher to the temper of the razor, you gain the best effect.

Sir, yours respectfully,

John Meer.

Philadelphia, May 5th, 1831.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN FEBRUARY, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a *Machine for Cutting Sausage Meat*, and stuffing the same. Samuel Fahrney, Boonsborough, Washington county, Maryland, February 1.

Mr. Fahrney obtained a patent, or patents, for machinery for the same purpose, about two or three years ago, but of a different construction from the present. There was considerable resemblance, however, in the stuffing part, which therefore is not claimed in the specification before us.

The machinery used cannot be well described without a drawing, and this we do not think it necessary to give.

---

2. For a *Plough;* John Anthony, Zanesville, Muskingom county, Ohio, February 1.

The patentee says, that he has "invented a new and useful improvement in the manner of fastening, or attaching, the cast iron mould board of the plough, to the wrought iron share." This is all that he claims to have done, and as we are not aware that the improvement is a very great one, we shall content ourselves with telling what he has done, without explaining how it is effected, as we could easily devise several modes of accomplishing the same end, neither of which we should think worthy a patent.

3. For an improvement in the *manufacture of Potash;* Thomas H. Sherman, Hastings, Oswego county, New York, February 2.

We have in this specification the announcement of some magnificant chemical discoveries; one of them is that salt will burn up, and that lime will become potash. Lest those who are adepts should be inclined to doubt, we will give the discovery in the words of the philosopher to whom it is due.

"The compound used is salt, lime, and lamp oil. First, when beginning to melt after the salt has done rising, it can then be ascertained what quantity of potash you are going to have. Suppose one barrel; first take a half a bushel of salt, sprinkle half of it over the top of the potash. Secondly, take two bushels of slaked lime, add that in the same manner, then the remainder of the salt; and when the lime has disappeared, then add half a pint of lamp oil. This is the quantity used for one barrel, but it may be varied as the nature of the case may require. First the use of the salt is to create a heat, and to purify the potash, as it is supposed to burn up and add nothing to the quantity, but to the quality. Secondly, the lime is supposed to melt and become the first rate potash. Thirdly, the oil is to create a blaze to consume. Fifth, these are the contemplated uses of the above ingredients as used by me.

THOMAS H. SHERMAN."

If a patent had been required for deteriorating one of the staples of our country, the one under consideration would most completely have fulfilled the intention; and it is earnestly hoped that its validity may in some way be tested in our courts of law, where we apprehend, it would not be esteemed to be a "useful invention," according to the intention of the patent law; as its inevitable result if acted upon, must be to injure the reputation of American potash in foreign countries; the material would be entirely spoilt as regards its use in many manufactures.

---

4. For an improvement in the Cylindrical *Sheet-iron Cooking Stove;* Emma Steinhour, city of Philadelphia, February 3.

The petition informs us that the invention is an "improvement upon the cylindrical sheet-iron stove used in the burning of anthracite; by appropriating the heated air thereof, after it has passed through the body of the fire, to the purposes of roasting, boiling, baking, and performing a variety of culinary operations by means of different apparatus and fixtures."

The foundation of the apparatus is the ordinary round sheet-iron stove, lined with fine clay. Kettles with tubes projecting from their sides, are made to boil by passing these tubes through the sides of the stove. The heated air, instead of being at once conducted off, is to pass through a tube into a sheet iron-box, or roaster, in which meat, &c. is to be roasted. From this a pipe conducts the warm air into a hollow sheet-iron shelf, upon which plates, dishes, &c. may be placed, and from this it is finally carried into a flue, by a pipe. The top of the stove takes off, and may be replaced by an oven, or by boilers for vegetables.

The claims are to the mode of roasting by heated air; of boiling around or on the top of the stove, and at the same time of baking and roasting by means of heated air; for heating flat irons, broiling, frying, &c.

We have received assurances from persons who tested the goodness of this stove in their own families, and who are well qualified to judge of its merits, that it is well adapted to all culinary purposes; that it is very economical, and that the most delicate food does not acquire any unpleasant flavour by its exposure to the gas which has performed the office of combustion.

5. For an *Inclined Water Wheel;* William H. Squires, and Coral C. White, Ledyard, Cayuga county, New York, February 5.

This inclined water wheel is placed in the manner of the inclined wheel upon which horses, or other animals, are sometimes made to walk, and propel machinery. Buckets are formed around the periphery, on the upper face of the wheel, and the water is received upon its upper, and discharged on its lower edge.

When the water is low, and a greater power is wanted, it is proposed to place a horse upon the wheel, and thus to obtain the combined action of the animal and the water. When this is to be done the face of the wheel must be floored, and the flooring allowed to cover the inner ends of the buckets.

There is no claim made, and the patentee therefore supposes the whole arrangement to be new; in this, however, he is in error. There has long been in the patent office a model of such a water wheel.

We do not perceive in what particular this wheel possesses advantage over other modes of applying water.

6. For an improvement in the apparatus for *Applying either simple or medicated Steam to the human body;* Boyd Reilly, Cincinnati, Hamilton county, Ohio, February 5.

This, as will be seen by the title, is a steam doctor's apparatus. The culprit—patient we mean—is to be laid upon a couch made for the purpose, and is to be covered over with a frame made of hoop iron, covered with cloth, &c. so as to have the form of a wagon top. The cloth is to be varnished, to render it steam tight, and is fitted perfectly to the frame of the couch. An opening is left at one end for the head of the subject, and the opening closed around his neck by means described in the specification. A tube from a metallic apparatus for heating the materials to be converted into vapour, opens into the cavity of the apparatus. The vapour of water, either simple or medicated, is sometimes to be used, but the favourite application appears to be sulphur.

The *familiar* tells us that "when sulphur is used it discolours the skin of the hands, until the scarf skin peels off. This may be prevented, if desired, by having coverings for them of the same material as that for the neck, the penetrating nature of the sulphur causes it to be painful to [parts of great delicacy,] they should be covered by a bag in like manner."

"Although I have made this application some hundreds of times, being a mechanic, I require the patient to take medical advice in cases of difficulty. In simple cutaneous or rheumatic cases, I pursue the following course. If the patient's skin is in a dry state, I generally cause perspiration in a few minutes by steam from half a pint of water;" "the water being removed, a full half ounce of roll brimstone is put into the empty vessel, which in this small apparatus takes as long to burn as the patient can conveniently remain in it." "In this recumbent position the patient seldom feels faint unless previously reduced. Should such symptoms appear, the sulphur may be removed to the back of the fire place, the usual applications being made to the patient, such as admission of fresh air, vinegar, cold water," &c.

It is useless to waste reasoning upon those who appear by their acts, to consider ignorance and temerity as the best diploma which can be exhibited of the skill of a professor of the healing art; and whilst this class of patients is numerous, freebooters will be found in abundance, who, taking advantage of popular ignorance, are ready to sally forth, to "burn, sink and destroy."

---

7. For an improvement in *Boxes and Hubs for Carriages*, and in Ship Blocks, and boxes for machinery; Isaac Cooper, city of Baltimore, February 7.

This is a modification of Garnett's friction rollers, but, in our judgment, is no improvement upon them. Round the axle, and within the hub, or box, four rollers are to be placed. These rollers are not to have axles, but are to roll round upon the main axle and within the hub. Between these rollers four others are to be placed, one between each, and of about half their diameter; the whole when together are to fill the circle. The smaller rollers are kept in their places by a flanched ring at each end, to enter which they exceed the larger rollers about an inch in their length.

The claim is, to "the principle of the roller without any axle, as applied to axles, shafts," &c.

This plan will not remove any of the difficulties experienced with similar rollers; as, in Garnett's plan, the axles, which merely confined them in their places, occasioned but very little friction. We err greatly if the rollers without axles will not, by continued use, produce more friction than the former.

---

8. For a machine for *bending Tin Hoops and Bands*; Daniel Shepardson, Hamilton, Madison county, New York, February 7.

The bending is to be performed by means of three rollers, in a way well known to workmen. The machine is so constructed that the distance of the rollers may be varied, according to the size of the hoop to be formed. The drawing accompanying the specification is sufficiently descriptive, and has abundant references to it. The written description, however, is extremely meagre and inadequate, and there is no claim made. This is to be regretted, as the particular arrangements appear to have been devised with much skill, and the general principle is not new.

---

9. For a *Thrashing Machine;* William Emmons, city of New York, February 7.

This contains all the usual appendages of thrashing machines. The teeth upon the cylinder are to be in rows, and from 1 to 1½ inches long. They are to be bent back so as to form a semicircle, declining from the grain. The hollow segment is to be borne up by spiral springs. The claims are to "the peculiar construction of the cylinder, in contradistinction from any other before known. The form of the teeth turning back in a semicircle. The form and construction of the circular bed, with the teeth, and the manner of setting it on springs."

---

10. For a *Thrashing Machine;* Truman Fox, and Wm. G. Borland, Little Falls, Herkimer county, New York, February 8.

We have again a thrashing machine of the ordinary form, with the addition, however, of a fly wheel, which is an appendage not attached to the whole of them; nor is it necessary when the cylinder is weighty and has a very rapid motion.

"What we claim is the construction of the receding concave, by means of springs, or lever and weights; and the staple teeth; and the fly or balance wheel."

The teeth are formed of wire, and bent so as to drive in at both ends, like a staple: this, we believe, is new, but the other parts claimed have so many previous claimants, that it is impossible to designate the true and original owner, though we can with some confidence say who is not so.

---

11. For a *Reaction Water Wheel,* for impelling saw mills and other works; Joseph C. Strode, East Bradford Township, Chester county, Pennsylvania, February 8.

(See specification.)

---

12. For an improvement in the *Carpenter's Plane;* Phinehas Meigs, Madison, New Haven county, Connecticut, February 9.

The objects to be attained by this invention are to cause a single iron to have the effect of a double iron; and to secure or detach it with greater facility than in the ordinary mode of fastening. The plane is, in fact, a double iron plane of a peculiar, and, undoubtedly,

a new construction. The opening, forming the mouth of the plane, is mortised through in the usual manner, excepting at the ends, which are perfectly flat, as no wedge is to be used. A plate of iron is let in on each end of the mortise, extending from the top to the face of the plane, and secured in its place by grooves, into which its edges fall, and by a screw passing into the stock. A flat plate of iron, similar to the cap of the double iron, has a pin projecting from each side of it, at about three-fourths of an inch from its lower end; these pins pass into grooves prepared for the purpose on the side plates, and a joint is thus formed upon which this cap iron moves; the pins rest upon the bottoms or lower edges of the grooves, which keep the iron at a proper distance from the face of the plane. Near the upper end of this cap piece, there is a thumb screw, which serves instead of a wedge to fasten the cutting iron. The cutting iron is dropped into its place, between the cap iron and the stock; when there, the thumb screw is turned, and its point bearing on the cutting iron, throws the lower edge of the cap against that of the cutting iron, and fixes it in its place; the whole bearing being against the pins in the groove.

The claim is to the peculiarities described.

13. For a mode of *building Double Ovens in Chimneys and large Bakeries;* Reuben Bacon, and William E. Marshall; Walpole, Cheshire county, New Hampshire, February 9.

In the description given of this double oven, there is a degree of obscurity which we are unable to remove. It appears, however, that two ovens, one above the other, are to be formed of brick or freestone; the top of the lower constituting the bottom of the upper oven. They are to be built in the jamb of a kitchen fire place, as they are thus shown in the drawing; but in this there is no provision represented for using the heat from the ordinary fire, nor are we any where told where the fire is to be made; we learn, however, from the intimation in the claim, that it is to be below the lower oven. This of course disconnects it from the fire place, excepting so far as a flue may be concerned.

The patentees say, "what we claim as our invention, is, the construction of the double oven; or two ovens, one over the other, as hereinbefore described, which are both to be heated by one fire made in, and applied to, the lower apartment of the double oven."

14. For a *Thrashing Machine;* John Harman, Jr. Upper Wakefield, Bucks county, Pennsylvania, February 11.

The patentee says:—

"In this improvement I claim the concave of plank, channelled and faced with iron; the scourer, or upper concave of plank, channelled and faced with leather, the leather extending from the face of the concave; the beaters made of wood or iron, attached to the cylinder, in a triangular form, so as to strike the unthrashed grain in an angular direction; and the cylinder boxes regulated by screws."

The upper concave, above mentioned, is a semicircular covering to the cylinders, which cover has channels, and strips of sole leather within it for the purpose of rubbing out clover, or other seed. "When this part is used, the seed, &c. enters the machine at the other end from that at which grain enters, is carried upwards by the beaters of the cylinder, and rubbed, or scoured out, between the beaters and leather filletting of the upper concave or scourer."

In other respects this machine resembles the ordinary thrashing machine.

---

15. For a machine for *Felting and Napping Hats;* Thomas J. Cornell, Randolph county, Vermont, February 11.

The hat body is to be bowed, set up, and basoned in the usual manner, it is then to be rolled up in the sticking cloth, when it is ready to be operated upon by the machine, which consists principally of a vibrating rack, and a revolving apron. The machine is placed over the kettle, into which a pump passes, the piston of which is operated upon by a part of the machinery, and supplies the hot liquid necessary to the operations of felting or napping. The structure of the different parts, and the gearing employed, cannot be described without drawings. The claim is to "the method of felting and napping of hats by means of a vibrating rack, and a revolving apron."

---

16. For an improvement in the *Manufacture of Gas for Illuminating Purposes;* Joseph Barton, of the city of New York, and a resident for two years in the United States, February 11.

(See specification.)

---

17. For an improvement in the *Manufacture and Setting of Porcelain Teeth;* Samuel Chamberlain, city of Philadelphia, February 11.

Pieces of platina wire are imbedded in the composition of which the tooth is made, previously to its being baked. These wires project from the top of the tooth, and to them the gold plate is to be soldered, by which the tooth is to be attached. There are some other points which are considered improvements, as will be seen by the claim.

"What I claim as new, and as my discoveries and inventions, are the glazing or enamelling the inside of the tooth, and polishing the gold plate, so that no unpleasant roughness may be presented to the tongue, and the tooth may not absorb moisture from the mouth."

"The manner of fixing the tooth by means of the pieces of platina and gold plate; and by soldering the spring that secures the tooth in the mouth to both the gold plate and the plug in the top of the tooth, which fixes the whole more firmly."

"The method of securing the tooth differs from all others in this essential particular, that is, that there is no interstice between the plates, or between the plate and the tooth, for food or moisture to collect."

---

18. For an improved *Machine for Cutting Sickles*, and which may be used with equal advantage and facility in cutting files; Simon Hornbenk, Lafayette, Tippecanoe county, Indiana, February 11.

The sickle, or file, to be cut is laid upon a suitable bed, which is carried forward like the carriage of a saw mill, by means of a rack and pinion. A crank is to be turned by hand, which gives motion to feed hands, operating upon cog wheels, in the ordinary manner. There are four teeth, or lifters, on the crank shaft, for the purpose of raising a hammer, which, in its fall, strikes a punch that is to cut the sickle or file.

For cutting sickles such a machine may possibly answer a good purpose, but for cutting files it is altogether worthless. We speak with confidence upon this point, as machines somewhat similar, but constructed with much greater skill, have been frequently tried. The best which has been made was one executed with the utmost exactness, by the late Mr. Voight, chief coiner of the mint of the United States, who was well acquainted with the nature of file cutting; his machine, however, has never come into use. The best mechanists of England and France also have failed in similar attempts, and that from the inherent difficulty of the subject.

The force of the blow requires to be varied, not only on different pieces of steel, but also upon different parts of the same piece, in consequence of the difference in its texture. The hand of the skilful workman soon becomes habituated to this difference, and adapts itself to these variations; but a machine never can be made to do this, however intellectual its inventor may be.

There is no claim made, and as there is little or no novelty in the machine patented, there was little or nothing to claim.

---

19. For an improvement in the *Mill for Grinding Corn*, and other grain; Elisha Bigelow, city of Washington, D. C. February 11.

Should the utility of this invention be commensurate with its simplicity, and the brevity of the specification, it will be almost invaluable. *To avoid prolixity*, we will give the whole description, as furnished by the patentee.

"My improvement on the mill for grinding corn, and all kinds of small grain, likewise plaster of Paris, may be applied to all mills which are now, or may hereafter be put into operation. Make an aperture through one of the stones; it is thought best to make a number of apertures through the cap stone, or runner, according to the size of the stones. By this improvement being applied, any required momentum may be given to the stones, and the atmosphere having a free circulation through the apertures will prevent the meal from clogging or heating." "ELISHA BIGELOW."

The drawing represents an upper stone with a number of holes drilled through it.

---

20. For machinery for *making Bats for Hat Bodies;* Stephen Hurlbut, Glastenbury, Hartford county, Connecticut, February 14.

The wool is to be received from a common carding machine upon an endless apron, which apron receives a vibratory motion, that it may cross the wool as it delivers it upon the former. "The former is a light wheel, or table, having a horizontal rotary motion; and on the former is a roller; the roller is attached, by a swivel in its centre, to the apron on the former, and its outer or extreme end is secured to the frame of the carding machine, by means of a swivel and wire."

"The operation of the machine is as follows:—The web is received from the doffer of a common carding machine upon the apron. It is carried by the apron to the former, and by the vibratory motion of the apron the web is crossed, as it is received between the former and the roller. The variation in thickness of the bat, for the formation of the body, must be regulated by the feed of the carding machine. The size of the bat for the formation of the body is regulated by a limb from the standard of the apron to which there is a crank pulley. When the bat is completed, it is torn from the circumference to the centre, gradually rolled over, and following the former through one of its revolutions, is taken off without stopping the machinery. The bat is then divided into three equal parts, which forms three hat bodies."

"My claim for a patent is to the whole of the foregoing description attached to the carding machine, and for crossing the webbing, and making the bat."

The drawing which accompanies this specification is a very imperfect one; and is not indeed worthy the name of a drawing, although it serves to give some general idea of the plan. The claim as it stands would seem to include the revolving apron; in this case it appears to be too broad.

---

21. For an improved *Machine for Spinning Wool;* David Wooster, Sheldon, Genessee county, New York, February 14.

The common wheel for spinning wool is to be made to turn a number of spindles,—eight are shown in the drawing. The rolls of wool are to be fixed in an apparatus to be held in the hand: this contrivance consists of two strips of wood, 18 or 20 inches long, hinged together, and capable of being opened and closed readily, and in this the rolls are to be secured. There is nothing in the arrangement to recommend it to particular notice, nor is there any claim made.

---

22. For a *Thrashing Machine;* Jacob Ketzle, and Jesse Bevier, Ithaca, Tompkins county, New York, February 14.

"What we claim is the teeth in the bars upon the cylinder acting upon the grain over the concave of bars, with or without teeth; and also the cylinder being fixed and stationary, so that it cannot raise or fall except at pleasure."

These claims are no doubt as good as any that could be made to the machine described. The difference between the teeth of this machine and many others, is, that in this, they are made on plates of metal like saw teeth, and fixed along the cylinder.

There has never been a dearth of newly patented thrashing machines, but of late they have sprung up with a rapidity quite unusual; this is to be attributed to the success of one or two patentees, who, if their machines are not of a superior order, have been indefatigably active in bringing them into use.

---

23. For an improvement in the mode of *Pressing Cheese*, by a "Lever and eccentric wheel cheese press;" John C. Pulsifer, and Ebenezer Pulsifer, Ipswich, Essex county, Massachusetts, February 14.

An eccentric wheel is placed upon a shaft which crosses the press horizontally; this comes in contact with a roller, or friction wheel, on the top of the follower. When the shaft is turned by a lever, the eccentric wheel is brought into action, and weights hung upon the lever will cause it to operate continuously.

Presses with double and single eccentric wheels, acting exactly upon the principle of the press described, are no novelties. The patentees do not make any claim.

---

24. For constructing *Stoves, or Flues, for the Curing or Drying of Tobacco;* D. G. Tuck, Halifax county, Virginia, February 15.

(See specification.)

---

25. For an improvement in the *Plough;* Timothy Miller, Pittsburg, Allegheny county, Pennsylvania, February 15.

The patentee states in his petition that his improvements consist in "a moveable piece on the side next to the land, and forming part of the under side, from the heel, or hinder end, to about half the length of the land side, or runner of the plough, which, when worn at the heel, can be renewed at any time, by unscrewing the old, and putting on a new *renovater.*"

---

26. For an improvement in the *Overshot Bucket Wheel* used in Hydraulic works, or machinery; D. S. Howard, Lyonsdale, Lewis county, New York, February 16.

(See specification.)

---

27. For an improvement in the apparatus for Distilling;

Charles Otis, Tunkhannock, Luzerne county, Pennsylvania, February 16.

(See specification.)

---

28. For an improvement in the *Manufacture of Buttons* called "Metallic Shank Buttons;" Josiah Hayden, Williamsborough, Hampshire county, Massachusetts, February 17.

Who is the true and original inventor, or discoverer, of this improvement in buttons, we wot not, but the present patent is taken for the same mode of making buttons as that described in the last number, (No. 22 on the list,) and such is the resemblance in matter and manner, that it is probable they are both from the same mind, although the claimants reside no small distance apart.

---

29. For an improvement in the *Steam Boat Paddle Wheel;* Timothy Hunt, Boston, Massachusetts, February 17.

This is another patent for a mode of causing the paddles of steamboat wheels to enter and leave the water vertically. The general arrangement is similar to that of several others which have been patented both here and in England. Two wheels eccentric to each other operate upon the buckets; the particular arrangements in the present case are made with great skill; the specification and drawing fully and clearly present the whole design, and the parts claimed are distinctly designated: we apprehend, however, that the practical difficulties which have prevented the adoption of similar plans, will not be removed by that before us.

---

30. For an improvement in the *construction of Steam Boilers;* Levi Disbrow, city of New York, February 18.

(See specification.)

---

31. For a mode of *constructing the Rotary Steam Engine,* called the "Double Chamber Rotary Steam Engine;" Joel Eastman, Bath, Grafton county, New Hampshire, February 18.

The patentee informs us that "the rotary or revolving part of this engine may be constructed in various ways, not essentially differing from other rotary engines; the distinctive character of my engine being the employment of two chambers upon the same shaft, by which the action upon the fixed heads, is rendered equable."

The steam is admitted and discharged through openings in the fixed heads; and to them are attached the metallic stops which fill the chambers, and cause the steam to react upon the valves. Instead of the ordinary stuffing, it is proposed to close the juncture between the revolving cylinder and the fixed head, by driving wood, endwise of the grain, into a groove prepared to receive it, which being turned off, is to run against the metal.

The claim is to "the employment of two chambers on the same shaft, in which the heads that form the exterior ends of the chamber are fixed, or stationary, and by the use of which two chambers the force or action upon each end is equalized."

32. For a *Water Wheel for Mills*, in which the floats work upon hinges, or joints, and are enclosed within the rims of the wheel and a circular apron; Joel Eastman, Bath, Grafton county, New Hampshire, February 18.

"This water wheel may be made of cast and wrought iron combined; its diameter may vary from two to six feet. The rim of the wheel is to be partially surrounded by a circular case, or apron, which will confine the water within the rims, and between the buckets or floats. The floats are made to work upon joints, or hinges, and the water is conveyed on to the buckets, or floats, through a penstock, or close trunk, extending the whole height of the fall. The buckets, or floats, are to be opened and closed by apparatus appended to the wheel, to the frame, or to the plummer block on which it rests."

The junctures of the revolving parts are to be closed by strips of wood, driven into grooves, as in the foregoing article.

The claims are to the application of a water wheel constructed as above described; that is, with floats or buckets, which are opened and closed mechanically, independently of the action of the water, and the confining the water within the rims, by means of a case, or apron, whilst operating upon the floats, or buckets.

The motion of the buckets upon their hinges is effected in a manner similar to that of the valves in several rotary engines.

33. For a *Machine for Pointing Pegs for Boots and Shoes;* William A. Greenwood, Palmer, Hampden county, Massachusetts, February 19.

Although the drawing which accompanies this specification represents the whole machine very well, yet those parts upon which its operation principally depends, are neither shown or described in detail. There is a part called the cutter, which is to point the pegs, and, we suppose, from the general representation, that it operates like a plane, with a sharp angle, and grooves the end of the block which is to be split into pegs. A carriage upon which the block is placed is made to advance by regular steps, as the cutter works. The whole is set in motion by means of a crank. The claim is to the whole of the foregoing machine.

34. For an improvement in the *Sawing of Boards* by means of a machine called the Economical Sawyer; Reuben Jacobs, Wilton, Saratoga county, New York, February 22.

"The objects proposed to be accomplished by the economical sawyer, are to saw boards and other timber without a stubshot, and to gauge the thickness of the board, or other thing, into which the saw log is to be sawn, and to keep the saw log plumb while it is being sawed."

The mode of effecting these objects is particularly explained in the specification; the head blocks of the carriage of a common saw mill have the dogs so constructed and arranged, and there is a rack and pinion for the purpose of moving the log, constructed in such a way as to attain the proposed ends. The claims are to the particular parts represented as the invention of the patentee.

---

35. For a *Machine for moving Earth, Stones, &c.;* Shadrach Davis, Dartmouth, Bristol county, Massachusetts, February 22.

The body of this machine resembles the common scraper used for removing earth; but, instead of a straight cutter, the edge is formed into points like those of the shovel plough, which are intended to cut the ground more easily than the ordinary cutter.

It is proposed to mount this scraper upon a carriage, with wheels, so constructed, that by means of shafts and chains acted upon by levers or cranks, it may be lowered, to allow its points to enter the ground, and that when loaded it may be raised and removed where required. When the earth is to be deposited in the vicinity, it is to be used, like the common scraper, without a carriage. The claim is to "the points, or shares with cutters in the fore parts; and the application of said scraper to wheels, and the form of hanging it; together with the applying of said points to scrapers drawn without wheels."

The drawing accompanying this specification, which is referred to throughout, is wretchedly executed, leaving most of the parts, and all the particulars, to the imagination.

---

36. For an improvement in making *Bedsteads;* Rufus Belt, Centreville, Bourbon county, Kentucky, February 22.

The great improvement here claimed has been so often patented, that if the mere act of patenting will afford security, it must by this time be well secured. On one end of each rail there is to be a right hand, and on the opposite end a left hand screw, which are to screw into the opposite posts by turning the rail one way. Were the contrivance new, it would still be a poor one, and we apprehend that age has not improved it. Those who know any thing about cutting screws, especially in wood, are aware that it is nearly impossible to cut two which should bring up to the shoulder correctly, and that were they made to do so at first, they would still wear and strain unequally.

There have been at least three patents for this very same affair granted within three years.

---

37. For a *Fire Engine;* Nathan Pierce, Whitehall, Washington county, New York, February 23.

Two cylinders are to be used in this engine, each of which is to act as a double forcing pump; having a supply and a discharge pipe at each end, with their proper valves, and the piston rods working through stuffing boxes. The four supply pipes terminate in one common suction pipe, and the four discharging pipes also unite in one.

It is proposed to work this pump by turning a crank, or cranks, from the shaft of which pitmen operate upon the pistons of the barrels. No mention is made of an air chamber. There is no claim made, but we are told that "some among the many advantages of an engine constructed upon the principle above mentioned, over any that have previously been built, are, that the cost of building it will be much less; that a more uniform and constant stream of water may be forced out; that the friction is so much less, and the machinery so simple, that it is believed that not more than half the power necessary to work an engine upon the old plan, will be requisite for this; and, finally, that it will be much less liable to get out of repair than any that have been made upon different principles."

It would have been more satisfactory had the patentee told us for what, in particular, he takes his patent; we suppose, however, that it is for the *application* of one cylinder as a double forcing pump, to the fire engine, as in the principle of the pump there is nothing of novelty.

We are compelled to dissent from most of the conclusions at which the patentee has arrived; we cannot conceive that a pump with eight valves is more simple, or less liable to get out of order, than one with four, or that pistons which are to work water tight through stuffing boxes, will require as little attention as those with open cylinders. We are also of opinion that the engine must cost more than the ordinary double chamber engine; and a *more* uniform and constant stream of water than is thrown by a well made fire engine of the usual construction is scarcely possible, and certainly impossible without an air vessel.

---

38. For an *Axletree* for wheel carriages of all descriptions; Rezin Haslup, Baltimore, Maryland, February 24.

The axle is to be divided into two parts, and is to run in collars upon the carriage, instead of in boxes in the wheels. The end of the axle which enters the wheel is to be square, and fixed permanently in it.

There is no claim, and axles have, in many instances, been fixed in this manner; what there is of novelty in the proposed mode of doing it, we are unable to discover. In Eastman and Rix's wheel, mentioned at p. 252, the axles are so fixed.

---

39. For a composition of matter to be used in the art of *House, Coach, and other Painting;* Chandler Metcalf, Hanover, Grafton county, Maine, February 25.

"The compound, or composition of matter, is to be used in mixing paints and putty. Take one gallon of common soft soap, or a sufficient quantity of bar or brown soap to make a gallon of soft soap, add six gallons of rain or river water, having previously dissolved in the water one ounce of sugar of lead to every gallon of water; mix these ingredients well together; then add, for outside painting, six gallons of raw unadulterated linseed oil; or a less quantity of oil will answer for old buildings, and rough kinds of work. With this composition mix, or combine, paints formed from or combined with lead, as well as all other paints or colouring substances used in painting. The paints to be ground, mixed, and laid on in the same way and manner as when mixed with clear oil, as has been heretofore practised. For painting oil cloth, coaches, signs, insides of houses, &c. where the paint is required to dry expeditiously; instead of using all raw oil, as above, use a part, or all, of boiled oil; in all cases thinning the paint with the above composition, or spirits of turpentine."

The foregoing is the whole of the descriptive part of the specification. What benefit the soap is to produce we are not told, but its effect, undoubtedly, must be to render the paint less durable, or more readily acted upon by water. We see no difference between mixing soap with the oil, or adding to it a portion of caustic potash, which should convert a part of it into soap, and thus render it miscible with water.

---

40. For an improvement in *Mortise Door Fastenings;* Leonard Foster, Boston, Massachusetts, February 25.

This is to be a substitute for the common mortise lock; but it is to be so constructed as not to occupy more than half the width, or thickness, usually required for such locks; adapting it, therefore, to thinner doors, and weakening the door much less than ordinary.

The bolt is to be shot forward either by a turning or sliding knob, which projects through the escutcheons. The escutcheons are to be made of metal plates, three inches square, and as the body of the lock is but two inches, the screws by which these are fastened enter the solid parts of the door, above and below the lock. On the inside of the door there is a small bolt which enters the main bolt, and secures it in its place. When it is desired to have the door to lock on the outside, a small lock, like those used for drawers, is fixed under the bolt of the mortise lock, which has a notch in it to receive the bolt of the small lock. The advantage, thus obtained, is the carrying of a small key instead of a large one. To enable the bolt to spring back as the door closes, the plate on the door post is made to slope, the thickness of the bolt itself not being sufficient for that purpose.

The claims are to the construction and arrangement of the various parts of the door fastening.

---

41. For improvements in the *Printing Press;* Amos Sherman, city of New York, February 26.

The cheeks and cross timbers of this press resemble those in com-men use. The platten is worked by a toggle joint, and borne up by spiral springs in the manner of many of the modern presses. The handle, or lever, is fixed upon the middle of the near cheek, and when the platten is raised, its position is nearly vertical. The pull is downwards, which the patentee says is the most advantageous way of working. There is a mortise made through the cheek, through which a rule joint passes, and upon this the lever acts, which operates upon the toggle joint.

The press is double, having a form, inking apparatus, frisket, and other appendages on each side of the platten. There is a rounce also on each side, as it is intended to employ two men to work the press, and two girls to attend to the sheets. The two parts are connected by iron bars, which can be removed, and the press worked as a single press, when desired. The claims are in the following words.

"First, I claim that part of the press as I have described it, forming a single combination; its main parts consisting of the bar handle, the two upright pieces, and the two horizontal pieces. I do not claim the bar handle, nor either of the four pieces abstractedly, but I claim the bar handle as used by me in its upright position, that position being the easiest for working. I claim the bar handle and near horizontal piece as united by me by the joint; regard being had to their relative situations and the purpose they serve. I claim the two upright pieces and farther horizontal piece, as they are moved by the near horizontal piece, and as the further horizontal piece is united to the near horizontal piece. I do not claim the toggle joint abstractedly, but I claim it as constructed and moved in the peculiar manner I have described it, with the horizontal piece between the two upright bars.

"Second. I claim the cylinder for winding up the blanket, not abstractedly, but for this purpose, and also for drawing out the frisket. I claim the roller with its bellying form, inserted in the cylinder, and the channel in which it revolves, and the union of the roller and cylinder for the purposes which they serve. I claim the blanket, not abstractedly, but as made in one piece, and placed as I have described it, held at one end by the rollers, and at the other by the lath. I claim the lath with its bellying edge, for the purpose of holding and straightening the blanket. I claim the guides of the lath for the purpose which they serve in being forced towards the platten by the frisket guides, and forcing the frisket guides from the platten. I claim the hooks on the corners of the bed, the guides on the corners of the frisket, and the ways containing channels in which the rollers run, as I have described them, and for the respective purposes which they answer in carrying in the frisket and blanket. I claim also the ways containing grooves in which the guides of the lath and frisket run for that purpose.

"Third. I claim the union of two beds in one press, pressed alternately by a single platten; and the union generally of the two halves of the press, for the purposes for which they are united. I claim the bar uniting the two beds, and the arrangement of the tail irons between the beds, to prevent the tail irons from interfering.

"Every other part of the press described above, except what I have thus claimed as my own invention, is not mine; but I declare the same to be old, and known before this my application."

42. For improvements in the *Steam Engine;* Hugh Gordon, city of New York, an alien, but having resided two years in the United States, February 27.

The steam engine of which this purports to be an improvement, is the vibrating engine working upon trunnions on the centre of the cylinder.

The patentee says, "the only parts and combination of parts of the above described engine which I claim as my improvements, are the following, namely, the double packed joint aforesaid, and the combining the vibrating engine with the double steam chest and slide valves, together with the opening and shutting of the steam passages by forming a connexion between the valve rod, and a detached standard at rest, by means of connecting rods, a forked lever, and a moveable standard."

Accompanying the specification are ten distinct and well drawn figures, explaining the particular arrangements adopted by the patentee; as these are all things of mere detail, they cannot be explained without engravings.

43. For an improved *Pendulum Churn;* Caleb Angevine, city of New York, February 28.

The churn is the common dasher churn, the rod of which is to be worked up and down by a pendulum. A frame is to be made, across the upper part of which there is to be a shaft turning upon gudgeons; from this hangs a weighted pendulum. The shaft is crossed by a lever, one end of which is attached to the dasher rod; from the other a pitman descends to a treadle. The pendulum may be made to vibrate by the hand; or the foot may be placed upon the treadle for the same purpose. The claim is to "the application of the pendulum principle to the dasher, which equalises the power applied, and assists in passing the reacting points in the rise and fall of the dasher; and also in the application of the foot power, which relieves the arms and chest in the act of churning."

We apprehend that this machinery would be improved by removing the frame, the shaft, the pendulum, the pitman, and the treadle, and taking hold of the dasher by the hands, as dairy maids have been in the practice of doing from time immemorial.

Specifications of American Patents.

Specification of a patent for a Machine for Impelling Saw Mills and other works by water, called Strode's Reaction Wheel. Granted to Joseph C. Strode, *Teacher, East Bradford, Chester county, Pennsylvania, February* 8, 1831.

There is a wooden shaft seven feet six inches long, sixteen inches in diameter at the larger end, and fourteen at the smaller; in the centre of this shaft, is made a round hole eight inches in diameter at the larger end, and six at the other; the area of this hole will vary directly as the power required, and inversely as the subduplicate ratio of the height of the head above the centre of the shaft.—*a*, *a*, *a*, *a*, are six hollow arms, six inches in diameter, set perpendicularly in the shaft, A, at equal angular and linear distances, forming a true spiral curve from one end to the other. The holes through these arms are three and a half inches in diameter. Near the end of each arm is a hole one and three-quarters inch in diameter, so situated that the axis of the shaft, A, is perpendicular to the plane passing through the axis of the hole and that of the arm, and so that a plane passing through the axis of the hole perpendicular to the aforesaid plane, shall be a tangent to the circle formed by the middle point in the axis of the hole, by the revolution of the machine on its axis. The distance of the centre of this hole from the centre of the shaft, is thirty-three inches, and will vary directly as the power required and the subduplicate ratio of the height of the head above the centre of the shaft, A, and inversely as the number of revolutions desired. The area of the hole will vary inversely as the subduplicate ratio of the height of the head, and directly as the power required. The distance between each two of the planes passing through the axis of the arms to which the axis of the shaft, A, is perpendicular, is eleven inches, and will not answer to be nearer, because the water from each arm nearer the larger end would impinge against the back of the next arm, and thereby impede its motion; so that if the number of arms be increased, the length of the shaft must be increased in proportion.

The arms are made fast in the shaft by means of a tennon with a dovetail, as represented by figure H, the side of the tennon on which the dovetail is made is rather narrower than the opposite side, and the mortise in the shaft is of the same shape, so that when the wedge, I, is driven in on the side opposite to the dovetail, it will be firm and tight on all sides.

B, is a hollow cylinder eight inches in length with a rim on one end, one inch and a quarter wide, and three-quarters of an inch thick. The diameter of the hole is eight inches, the same as that in the shaft A. Its diameter from out to out is nine inches and a half, half its length; the other half, or the part *h*, is nine inches and a quarter at the shoulder where *g* terminates, tapering to the end, where it is nine inches. This cylinder is let through the plank, D, of the trunk, which is three inches thick, with its rim on the inside, which is sunk in the plank three-quarters of an inch deep, or so as to face with the inside of the plank. It is made at the same time firm and water tight by means of eight screw bolts, each three inches and a half long, driven in from the outside through holes made in the rim, where it is screwed up firmly and rendered tight by means of burs. The part *h*, is four inches in length, and goes into the cylinder, F, which is of the same length, and is made fast in the shaft. It has four wings to keep it from turning. This cylinder is of such a capacity that it will work easily on the part *h*, and at the same time not allow too much play. G, is a lead washer one inch and a quarter wide, three-eighths of an inch thick, and its inner diameter eight inches. This washer and an iron follower of the same dimensions, are screwed against the ends of *h* and F, (which are turned so as to face exactly,) by means of eight screws going through them and securing into the end of *h*. This is in order to render them water tight.

B, is a cast iron friction wheel, fourteen inches in diameter, running with its periphery, which is turned true, against the iron band F, on the shaft, (the band being also turned,) thereby supporting the weight of the shaft, A, to prevent too much friction on the gudgeon, *h*, of figure E. The gudgeons of the friction wheel run on the middle of the two cross pieces, *d* and *e*, made of wood, which are supported by the upright pieces, *b*, *b*, of plank, two inches thick, spiked at the bottom to the sill, C, and made firm at the top by the inch board, *c*, going across from one to the other and nailed to each.

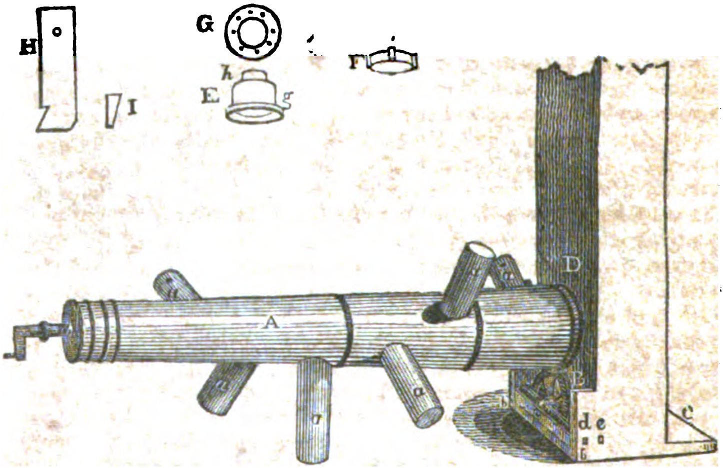
In the foregoing description are given the dimensions of a machine now in operation, for impelling a saw mill under a head of twenty feet. If a larger or smaller wheel is required, the dimensions of the several parts will vary according to the proportions given.

Some additional power may be obtained by the application of a funnel to each of the holes in the ends of the arms, *a*, *a*, *a*, *a*, &c. the small end of the funnel being applied to the hole, and the wide end standing outward. These funnels may be of small blocks of wood with a hole bored through the middle of each, and hollowed on the inferior side so as to fit the arms to which they may be attached, firmly, by nails or screws. The holes in the blocks should correspond in capacity and position on the inferior sides with the holes in the arms, and should gradually widen in the true funnel shape towards the outer surface of the blocks. These funnels may, or may not, be attached, at the option of the constructor; the machine will operate very well without them, though it is believed, from experiment, with some increase of power with them.

If a reciprocating motion is desired it may be obtained by means of a crank on the axle of the shaft A. In the machine above described the crank is at the end of the axle: but if the axle a little prolonged, be made to work on a point fixed in a permanent block placed directly opposite the smaller extremity of the shaft, and in the intermediate space between the end of the shaft and the block, the axle be so shaped as to form a crank, by which the reciprocating movement may be given, there will be less friction and consequently a gain of power.

JOSEPH C. STRODE.

Strode's Reaction Wheel.



Specification of a patent for a mode of constructing Flues, or Stoves, for the Curing or Drying of Tobacco. Granted to DAVID G. TUCK, *Halifax Court House, Virginia, February* 15, 1831.

To all to whom these presents shall come:—Be it known, that I, David G. Tuck, have invented, or discovered, a new and useful improvement in the construction of flues, or stoves, for the curing or drying of tobacco, by which the whole or greater part of the smoke, as may be preferred, is excluded, and the expenses consequent upon the process very much diminished; and that the following is a full and exact description thereof.

The material of which I usually construct the said flues or stoves, is common brick, as, under most circumstances, it is more readily obtained, and is less costly than any other. They, however, may be made of stone, iron, fire brick, slabs, or tiles, made and baked in the manner of brick, or of other materials.

The dimensions of my said flues, or stoves, must be varied to suit the size of the barn, or drying house, in which they are to be used; and they will also admit of considerable variation in this particular in houses of any size, whilst the principle of construction may yet be retained. For the sake of description, I assume certain dimensions, which I have found to answer the intention perfectly, but do not intend to establish any limit in this particular.

These stoves, or flues, are to be so constructed that they may be supplied with fuel from the outside of the house, and that the smoke, and other vapours from the fire, which it may be desirable to exclude from the interior of the building, shall, after passing through the larger flue, or stove, in which the fire is contained, to a spot near the centre of the building, return through a second, but smaller flue, which may be parallel to, and in contact with that first named, and be delivered, or have its exit, near the opening for feeding the fire.

Suppose my barn to be twenty feet square, and of the ordinary height. Near the middle of one end, or side, of the barn, I make an opening for the mouth of my flue, or stove; this flue, or stove, is a square, or arched trunk, about 30 inches in width, and the same in height. It is built horizontally upon the floor of the barn, and extends within it to the distance of about seven feet from the wall. The outer end, where the fire is to be fed, is furnished with an iron door of about a foot square. To receive the inner end of this flue, a square, or other formed pen, or box, is erected of brick, or other materials. This pen, or box, may be four feet in length, and two in width, and of the same height with the larger flue, or stove, which terminates in it. It should stand at right angles with the flue, or stove, which is to enter it on one of its broad sides. The smaller flue, through which the smoke is to return, also opens into this box, or pen, alongside of the large flue, and may return, and pass through the building, in the vicinity of the fire place, or feeding door. This second flue may be made of the same materials with the former, but need not be more than one-fourth of its size. From the end of it, a flue, or pipe, is erected perpendicularly to the height of four or five feet, to serve as a chimney to furnish a draft, and carry off the smoke. The interior diameter of this chimney need not exceed seven or eight inches; and an iron plate, or some other flat article, must be provided to stop the draught when required, by being placed upon the top of said flue.

It is manifest that in a structure of this kind, a fire may be made, and that the smoke will pass out at the chimney; but as soon as the wood is charred, and the fire burns clear, it is intended to admit the heated air into the barn, and to stop the draught through the flue, or chimney. For the purpose of admitting the heated air, the pen, or box, before described, is provided with an iron, or other door, or stopper, opening from it into the barn. This door may be twenty inches square; it may be fixed by hinges, or otherwise, so that it may be opened as soon as the smoke has ceased to escape from the chimney, and at this time the top of the chimney may have its cover placed so as entirely, or partially, to stop the draught through it.

A second flue, or stove, constructed exactly like the one just described, with all its appurtenances, is to be erected on the opposite side of the barn. The pens, or boxes, forming the termination of each of these flues, or stoves, will thus leave a passage of about two feet between them, on the centre of the floor.

These flues, or stoves, may be used either separately or conjointly; it will be found best, however, always to make a fire in each, as there will then be no interval in which the heated air from the fire may not be admitted directly into the barn.

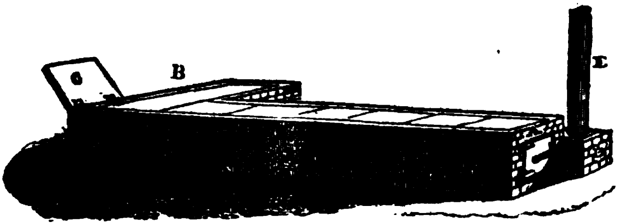
The manner in which the heat may be regularly distributed, and applied to the curing of tobacco, is fully described in the specification of a patent for a new mode of curing tobacco, which was granted unto me on the 1st day of October, 1830. To the system, or mode of procedure therein described, these flues and stoves are particularly adapted, but they may also be used when tobacco is cured in the ordinary way.

Where flues are carried directly through a barn, or drying house, the draft cannot be advantageously managed, and most of the heat is lost; a difficulty completely obviated by flues, or stoves, constructed upon the principle above described.

What I claim as my invention, or discovery, is the application of flues, or stoves, constructed upon the within described principle, by which the heated air from the fuel may be admitted, directly, into a barn, or drying house, for the purpose of drying and curing of tobacco, whilst the smoke may be entirely excluded. I also claim the returning of the draft of the flue, or stove, to a point, at or near to the feeding door of the stove, by means of which the draft of the fire is readily and perfectly managed, so as to produce great economy in the use of the fuel.

The escape flue, however, may be carried out at any part of the building, although not with equal advantage. It may, for example, be carried directly through the house, and yet the main object of my patent, that of admitting the heated air without the smoke, may still be attained. D. G. Tuck.

D. G. Tuck's Stoves or Flues.

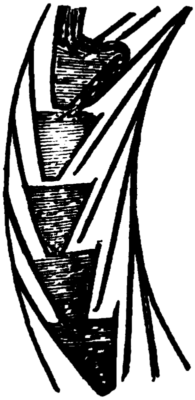


A, the stove for fuel. B, pen, or box. C, iron door, opening into the barn. D, return flue for smoke. E, pipe, or flue, to carry it off.

Specification of a patent for an improvement in the construction of a Bucket Water Wheel, used for the purpose of giving motion to hydraulic works, or machinery. Granted to Dean Samuel Howard. *Lyonsdale, Brantingham Township, Lewis county, New York, February* 16.

A common bucket water wheel is well known to be a series of buckets suspended at the end of a certain number of arms passing through a shaft hung up at each end by gudgeons, or pivots. The inside of these buckets is formed by the lining of the wheel; the bottom is a narrow board varying in width with the size and proportion of the wheel, with one edge jointed to the lining, and the other edge extending directly from the centre towards the circumference until it meets the front, which inclines from the circumference inwards on a straight line in a sectional direction till it meets the bottom, which forms the bucket.

Section of a part of Howard's Bucket Wheel.



The improvements thereon are as follows:

The bucket is detached from the lining of the wheel, so that the air has free access from one bucket to the other all around the wheel; the front is a board warped, or bent, in such a manner as to take and retain more water, longer than the common wheel; the front is wider than the back, so that all the surplus water must escape over the back, and none be thrown out by the centrifugal force. All the surplus water is directed into the bucket below, (which will hold more as the wheel turns,) by a board for that purpose forming the lining to the wheel and extending down by the back of the bucket. If thought necessary, the air might have access through the lining to each bucket.

D. HOWARD.

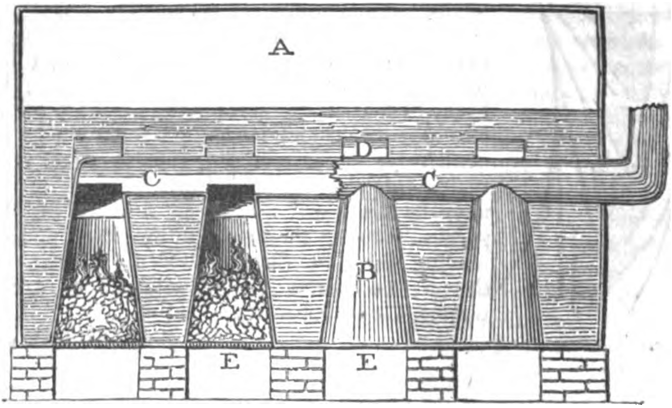
Specification of a patent for an improvement in the construction of Steam Boilers. Granted to LEVI DISBROW, *city of New York, February* 18, 1831.

THE object of this invention is the advantageous application of anthracite, or other, coal, to the purposes of heating water in the boilers of steam engines. The boiler may be made of cast iron or any other usual materials, of any dimensions adapted to the purpose. The water contained in the boiler is heated by means of two, or more, furnaces of a conical (or other) form, erected within the boiler, having their bases, or the grates through which the ashes fall, upon or near the same level with the floor of the boiler. The smoke or gas is discharged from the top of the furnaces, by one or more horizontal cylinders passing through the boiler to its outer surface. Each furnace is replenished with coal by means of a pipe or feeder of a cylindrical or other convenient form, passing from the outer surface of the boiler through the same into each furnace at, or near, its top. Each of such pipes is secured by a door, or other means, at the surface of the boiler, and fixed to the furnace with a flanch or other suitable connexion; and the horizontal cylinders above mentioned are also secured to the top of each furnace with a suitable flanch or connexion.

The said Levi Disbrow claims as his invention the advantageous application of heat to the boilers of steam engines, by means of two, or more, furnaces for anthracite, or other coal, erected within the boiler itself; and as parts of the same invention, he claims the mode of supplying such furnaces with feeders passing into them from the surface of the boiler, and also the mode of discharging the gas or smoke of the coal by a cylindrical pipe, or pipes, extending from the top of each furnace to the outer surface of the boiler.

Levi Disbrow.

Disbrow's Steam Boilers.



A, boiler. B, B, furnaces. C, C, pipes for smoke. D, D, feeders. E, E, grates.

Specification of a patent for an improvement in the apparatus for Distilling. Granted to Charles Otis, *Tunkhannock, Luzerne county, Pennsylvania, February* 16, 1831.

To all whom it may concern, be it known, that I, Charles Otis, have made an improvement in the apparatus used for distilling, and that the following is a full and exact description of the same.

The still may be constructed in the ordinary manner. A tube is to lead from the beak of the still into a tub, or vessel, which contains low wines. The top of the tub is made to fit steam tight, and the before mentioned tube passes through it, being also so closely fitted as to prevent the escape of any vapour around it, and extending nearly to the bottom of the vessel. The vapour from the beer which is contained in the still, will thus pass into the vessel containing the low wines, and cause the liquid to boil.

A tube leads from the upper part of the vessel of low wines, into a second tub containing a still worm, and called the heater. This heater is to be filled with the beer with which the still is to be charged. This beer becomes heated in consequence of the partial condensation of the vapour, in its passage through the worm. This heater is to be elevated, so that a tube inserted near the bottom of it may convey the heated beer into the still, when it is ready for a charge. From the worm in the heater the spirit is conducted through a cooler, in the usual way.

By this arrangement of the distilling apparatus, the low are converted into high wines, by the operation of the vapour of the beer contained in the still.

I usually insert the still in a second vessel, so as to distil by a water bath; in this case I economize heat by conducting the steam from the second, or outer vessel, by means of tubes, so as to heat a second still, or to aid in performing other operations in the still-house, to which it may be applicable. Sometimes I convey the steam through a tube, provided with a cock, from the outer vessel into the still. This, however, I do not claim as making any part of my invention.

What I claim as new, and for which I ask a patent, is the conducting the vapour from the first distillation of the beer, into a vessel containing low wines, in the manner, and for the purposes hereinbefore described.

CHAS. OTIS.

Note by the Editor.—We do not perceive the difference between the plan here specified, and that of William Cook, which will be found in Vol. 5, p. 157. That patent was issued in December, 1829.

Specification of a patent for an improvement in the Manufacture of Gas for illuminating purposes. Granted to JOSEPH BARTON, *city of New York, an alien, but a resident in the United States for two years, February* 11, 1831.

BE it known, that I, Joseph Barton, have discovered a new and useful improvement in the manufacturing of gas, for illuminating purposes, and of a portable nature, and that the following articles are used as a combination to produce said gas without smell, viz.

Tallow, spirits of turpentine and rosin fused together, and decomposed through red hot tubes.

Turpentine and alcohol, do. do.
Coal tar and rosin, do. do.
Coal tar and tallow, do. do.
Coal tar, tallow, and rosin, do. do.
Seneca oil, coal tar, tallow, and rosin, do. do.
India rubber and Hydro carbons, do. do.
Oil of turpentine and rosin, do. do.

The foregoing substances contain gaseous matter, which when mingled with the pure illuminating principle, diminish its intensity, and increase its bulk. The application of the combinations heretofore enumerated, is to unite two or more of these hydro-carbons, and decompose the mixture so as to form a compound on which chemical agents will act so as to separate the deteriorating from the beneficial, viz. spirits of turpentine by its decomposition furnishes the pure illuminating principle, (Carburetted Hydrogen,) mingled with free hydrogen, and carbonic oxide gases, both destitute of illuminating principle or properties, but with the addition of a small portion of rosin previous to decomposition, the carbonic oxide is converted into carbonic acid, which may be entirely removed by washing with an alkaline or earthy lixivium, and if to this a small portion of tallow, or oil, be added, it will have the effect of converting the free hydrogen which the mixture still contains, into pure carburetted hydrogen, which will be perfectly free from smell or smoke. If alcohol be added to turpentine, and the gaseous mixture resulting from its decomposition be passed through an alkaline lixivium, and thus purified from carbonic acid and other deteriorating gases, the gas thus produced will be the pure illuminating principle, which when compressed by a peculiar process into copper recipients with valves, may be made portable and applied to all uses where light is essential.

The method of making illuminating gases by a union of two or more vegetable, animal, or mineral hydro-carbons has never before been suggested or acted upon.

Joseph Barton.

Remarks by the Editor.—We were placed upon tiptoe, some months since, by the announcement in the New York papers, that a chemist of that city, Mr. Barton, had made some important discoveries in the making and using of gas, for illumination, and if we had not learned from experience to chasten our anticipations, the result would have been sore disappointment. There is not a single fact, or principle, noticed in the foregoing specification, with which every chemist was not perfectly familiar, and therefore there is not a point in it which can lay the slightest claim to discovery.

We are first told that the gas is "of a portable nature." What does this mean? How much more portable is it than the gas from oil, or from rosin, made at the New York gas works? If the patentee supposes, as he evidently does, for he makes it the very foundation of his claim, that two or more oleaginous, bituminous, or resinous substances have never been mixed together for the manufacturing of gas, he has but little knowledge of the history of that art. The name of *hydro-carbons* with which he labels these different articles, has not been enlisted into the ranks of the chemical nomenclature, and, we apprehend, will not be received as a volunteer. The last article upon the list of compounds to be used is scarcely made with a view to economy. The chemist would not wish to convert turpentine into rosin and spirits, for the sake of combining them together again, for the manufacture of gas. It appears, however, according to the chemistry of this specification, that rosin is to be added to spirits of turpentine in order to convert oxide of carbon into carbonic acid. We wish very much to see the rationale of this process, as, according to our philosophy, carbonic acid would be more likely to become oxide of carbon, by heating it in company with rosin, than the oxide of carbon to undergo the change above designated.

As regards the rendering the gas portable, the information given, is most meager, or rather there is no information whatever afforded; as the portable gas company of London knew, before they commenced their operations, that gas "when compressed by a peculiar process, into copper recipients, with valves, may be made portable, and applied to all uses where light is essential."

Specification of a patent for an improvement in Carriages and Wagons intended to travel upon Rail-roads. Granted to WILLIAM HOWARD, *Esq. Civil Engineer, Baltimore, Maryland, April 23, 1831.* (*With a Copperplate.*)

BE it known, that I, Wm. Howard, of the city of Baltimore, and state of Maryland, have invented a new and useful improvement in carriages and wagons intended to travel upon rail-roads, by means of which the flanches of the carriage or wagon wheels, are prevented from impinging on the rails, when these last vary from a right line in their direction, or, in other words, when there happen to be curves in the location of the rail-road, so that the friction of the flanch against such curved rail, is entirely saved; or, if the flanch should occasionally touch the rails, is so much reduced as to afford no material additional resistance. The contrivance, mode, or invention, by which this most desirable result is obtained, is specified in the following words, which contain a full and exact description of the construction and operation of the said machine as improved by me; and which is also illustrated by the accompanying drawing, which is made a part of this specification.

I employ two wheels, placed at a convenient distance in front of the carriage, or wagon, which I call *governor wheels*, and whose axis of rotation is always kept parallel to the axis of the fore wheels by a frame constructed for the purpose. Each of these wheels is composed of two parts, acting separately and distinct from each other—that is to say—the flanch, and the tread, or bearing part of the wheel. The bearing part of the governor wheel is made to revolve upon the axle, while the flanch is made fast to the same axle. The axle of the governor wheel is divided into two parts, on the inner ends of each of which is placed a bevel cog wheel, which two bevel cog wheels work into a third, placed on the side next the fore axle of the wagon wheels, and parallel to it; so that while one half of the governor wheel axle turns one way, the other half turns in the opposite direction. The three bevel wheels here mentioned are supported in a convenient frame, which also keeps the two parts of the governor wheel axle revolving on the same right line; all which is represented in Fig. 3. of the drawing. The centre bevel wheel, which effects a change of direction in the opposite parts of the governor wheel axle, moves upon an axle, which extends to, and under, the fore axle of the wagon wheels, and on the end of which is an endless screw. This screw works the end of one arm of a horizontal lever provided with teeth for the purpose, whose fulcrum is in a frame under the axle of the fore wheels and near one of the hubs, and whose other arm, which is bent horizontally at right angles with the first, is connected with and acts upon a horizontal bar, or arm, fastened to the axle of the hind wheels, as represented in figures *one* and *two* of the drawing. The wheels of the wagon revolve upon their respective axles, and the fore and hind axles, besides the usual coupling bar, are so connected, as that the axles may always be in the position of the radii of the curve on which they may be moving, according to the specification, or on the principle, of a patent heretofore obtained by me, for an improvement in rail-way carriages.

Now it is plainly to be seen that the carriage, or wagon, with its governor wheel, when travelling on a straight rail-way, will not have the flanches of any of the wheels to impinge against the rails. On arriving at a curve, however, the flanch of the governor wheel immediately comes in contact with the outer rail, and the friction there, causes it to turn round, together with the bevel wheel attached to it. The second, or intermediate, bevel wheel, is then set in motion, and the endless screw at the end of its axle, moves the lever that is connected with the bar from the hind axle; which, of course, changes the direction of that axle, and in so doing changes also, by the peculiar coupling aforesaid, the direction of the fore axle; and both the fore and hind axles are thus, by the friction of the flanch of the goveenor wheel upon the rail, brought into the position of radii of the curve upon which the carriage, or wagon, is then travelling, without the flanches of the main wagon or carriage wheels coming in contact with the rails.

The invention and improvement here specified may be applied at once to the fore wheels of the carriage, or wagon; which would then be governor wheels in their construction and mode of operation.

What I claim as new, and as my own invention and discovery, in the above described machine, and for the use of which I ask an exclusive privilege, is the separation and distinct action of the flanch, and the tread or bearing part of wheels to be used on rail-roads; and I also claim as my own, and as new and original, the particular combination by which the effect is produced, as described, and set forth in the above specification.

WM. HOWARD.

Explanation of the Drawing.

Figure 1, represents a side view of the carriage. In this, every part of the carriage that is not peculiar to the present invention, and which would interfere with its representation, is omitted.

Figure 2, is a plan of the carriage. In this, the main coupling bar between the axles, seen in Fig. 1, is omitted; and the fore axle is

Howard's

Self directing

Railway Carriage

1831

Fig. 1

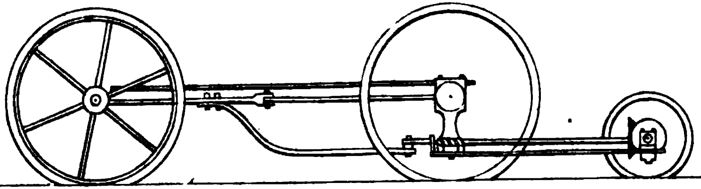


Fig. 2

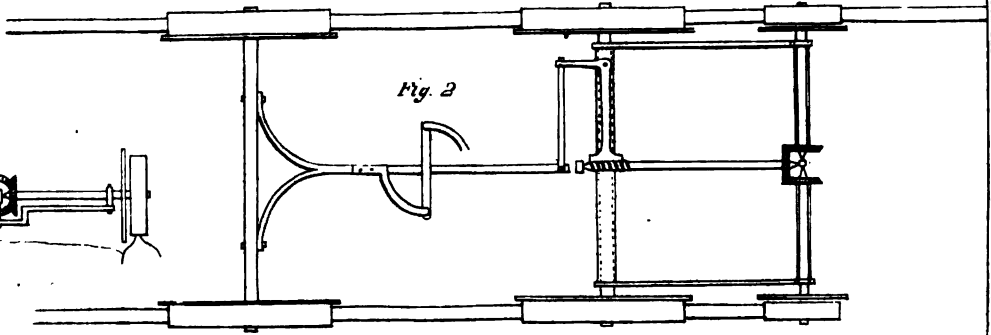
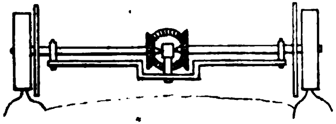


Fig. 3



represented by the dotted line. This arrangement permits the endless screw and the levers that effect a change in the direction of the axles, to be seen.

Figure 3, is a front view of the governor wheels, showing the manner in which the axle is divided, the bevel wheels, and the separation of the flanch and tread of the governor wheels.

ENGLISH PATENTS.

Specification of a Patent granted to CHARLES DEROSNE, *of Leicester Square, in the county of Middlesex, Gentleman, for certain improvements in extracting Sugar or Sirop from Cane-Juice and other substances.—Dated 29th Nov.* 1830.

To all whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Charles Derosne, do hereby describe the manner in which the said invention is to be performed, by the following description thereof, (that is to say:)—

The invention consists in a means of discolouring sirops of every description, by means of charcoal produced by the distillation of bituminous schistus alone, or mixed with animal charcoal, and even of animal charcoal alone. Whatever sort of charcoal it may be, it must be disposed on beds very thick, on a filter of any suitable form. The filter of itself has nothing particular, and does not form the object of the patent, because it is already known and used for other purposes, but till now it has not been employed for discolouring sirops. To obtain this discolouration, I put the charcoal in a case, in which I place at a distance of about an inch from the bottom a metallic diaphragm pierced with a great number of holes; I then place upon this diaphragm a clear and coarse linen or woollen cloth, which exactly covers it; I then place upon this cloth a bed of charcoal of bituminous schistus alone, or mixed with animal charcoal, or animal charcoal alone. Whatever it may be, this charcoal ought to be in a state of division, in order that it may be well penetrated with the sirop which is intended to be filtered. Charcoal in fine powder would not be penetrated by the sirop. It has been found that the charcoal reduced to the size of fine gunpowder is very fit for this operation; if the grain is too large, the filtration would be operated too rapidly. I lightly press the charcoal, and then again place new beds of the same charcoal, which should likewise be pressed till it has come up to the height of fifteen or sixteen inches. It may be made higher if found necessary, or it may be less, but the discolouring effect will be always in proportion to the thickness of the bed of charcoal. When the charcoal is disposed to the proper thickness, it is to be covered with another metallic diaphragm, pierced likewise with holes, upon which is spread another clear linen cloth; it is upon this cloth on which is poured the sirop which is destined to be discoloured. The sirop ought then to form a bed of several inches thick, from four to eight, although there is no precise rule. For operating well in the filtration of sirops, the sirop ought to be clear before pouring it upon the filter, and ought to have undergone a first filtration by the known means, the point to be obtained by the filtration through the thick beds of charcoal is only the discolouration of sirops. The sirop to be filtered ought not to pass over the consistence, which is produced by two-thirds of sugar and one-third of water; but it may be filtered at any less degree of consistency according to the result required. When the sirop is hot the filtration operates a great deal more rapidly. In operating on a great scale, a reservoir filled with sirop can furnish several filters at a time by means of cock-balls placed in each filter. The first portion of sirop which passes through the filter is always the most discoloured, and by the time the colouring part combines itself with the charcoal, the effect of the last portion becomes less sensible. The portion of sirops which preserves a part of its colour after its filtration, can be passed again upon another bed of charcoal in another filter, and by this means it may be obtained in a great degree of purification. Whatever the charcoal used, it is desirable to mix the charcoal with about one-sixth part of its weight of water before putting it in the filter. The place of that water is occupied by the sirop which penetrates the beds of charcoal, and then the water comes the first; it has a disagreeable and salted taste when the animal charcoal is used, the water after that comes mixed with a portion of sirop, and soon after it is displaced by the pure sirop.

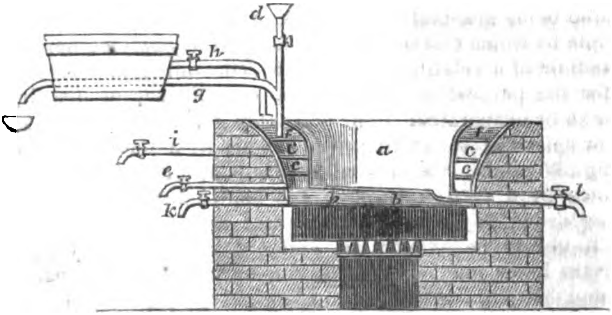
When the charcoal has been deprived of its colouring effect, pour water on the filter for dissolving or displacing the sirop which is mixed with the charcoal, the sirop then comes pure first, and after that mixed with more or less water, using as little as possible of water, it is convenient to suspend occasionally the effusion of water on the upper part of the filter, and to shut its cock. The sirop being heavier than the water, gains the bottom of the filter, and runs first. The sirops made with raw sugar by this process can be made as clear as water. The molasses are deprived of their bad taste, and are converted into a good kind of sirop of a clear and yellow colour. The sirops from which it is desired to separate colouring matter can be obtained directly from the juice of cane, or of beet-root, or from the saccharine matter produced by the action of sulphuric acid upon the farinaceous matters before these juices or liquids have been baked for extracting the sugar. The sirop may likewise be produced by the solution of all kinds of sugar, and of the products of inferior quality, which are obtained in sugar refining under the name of "bastards," and other sugars. The purpose of producing of sirops may be to sell them in such a state for the ordinary consumption, or to bake them for making sugar whiter than is obtained by the common process, or these whitened sirops may be used for discolouring the refined sugar, in making them filter through the loaves for replacing the use of the earth and water. The object of the invention being to obtain discoloured sirops by the means above described, this discolouration of sirops is always proportionate to their primitive colouration, and to the quantity of charcoal which is used. The carbonization of bituminous schistus has nothing particular; it is produced in close vessels, as is done for producing animal charcoal, only it is convenient, before the carbonization, to separate from the bituminous schistus the sulphurets of iron which are mixed with it. Instead of using the schistus, or animal charcoal of the size of gunpowder, it can be reduced to a powder still more fine, mixed with sand; in this state a given quantity of charcoal discolours better than powdered less fine, but the filtration is slower and more difficult to be regulated. After having tried this first method, I have given the preference to the other mode, but both of them are the object of the patent.

In witness whereof, &c.

Patent granted to WILLIAM SHAND, *of the Burn, in Kincardineshire, Esq. for certain improvements in evaporating Sugar.*

THE object of this invention is to evaporate sirop and other organic matters rapidly, without producing that carbonization or charring which invariably attends the direct application of fire to the evaporating vessel. Every colonial planter knows that rapidity of evaporation, at a moderate temperature, is highly conducive to the amelioration of the sugar, not only by preventing charring, which improves the quality, but also by increasing the quantity, more of the sirop being granulated, and less converted into molasses. The principle by which this object is effected, is by applying heat through the medium of a volatile substance, which, while it imparts sufficient heat for the purpose of evaporation, cannot char or discolour the matter to be evaporated. The substance employed for this purpose is oil or spirits of turpentine, which boils at a temperature not exceeding 320° Fah.; it is applied by means of a double copper vessel. as shown by a section through the centre thereof in the accompanying drawing: *a* is the evaporator for receiving the sirop or other liquid to be evaporated, and *b b* is the outer copper into which the inner one is fixed, leaving an intermediate space at the sides and bottom. Spirits of turpentine is poured into this space through the vertical tube and funnel, *d*, until it is in contact with the bottom only of the inner copper, any excess above this quantity being withdrawn by the trial cock, *e*. The object of this arrangement is, that the boiling oil may be directly applied to the *bottom* of the inner copper, while its vapour plays round its sides. It is essential that the hot oil should actually touch the bottom of the inner copper, since the heat communicated by the vapour alone is insufficient to maintain rapid ebullition, owing to the small quantity of latent heat which it contains, comparatively with that of aqueous vapour, the ratio being 175° to 960°; but provision must be made to prevent the escape of the vapour, or any portion of oil, and the mode of effecting this object, constitutes the peculiar advantage of this evaporator. This arrangement consists in a channel, *c c c c*, which commences at a given height above the bottom of the inner copper, passes around its sides, and terminates under the water gutter, *f f*, the bottom of which completes the upper part of the channel. The vapour is thus made to circulate round the sides of the copper, giving out its heat to, and being partially condensed by, the evaporating liquid, and subsequently being completely condensed, by a supply of water introduced for that purpose into the water gutter, *f f*, above mentioned. Since by extending the lower surfaces of the water gutter over the vapours, any degree of controlling power may be exercised, there is no risk of the oleaginous vapour escaping beyond this point; but if additional security were required, it would be easy to apply a subsidiary condenser, by conducting the tube, *g*, which communicates with the circular channel, *c c c c*, through a trough, or other convenient vessel of water, placed near the side of the evaporator. The water of condensation is conveyed to the gutter, *f f*, by means of the pipe, *h*, and it is removed, when it becomes hot, through the pipe and stop-cock, *i*. The pipe and stop-cock, *k*, is for drawing off the oil when necessary, and a similar pipe and stop-cock, *l*, is intended to draw off the sirop from the evaporating vessel.

The foregoing explanation refers in particular to the manufacture of sugar, because it is conceived that its application to this branch of industry, both in our colonies and in refining, will be found the most important; but the principle is obviously applicable to other purposes, as, for example, in procuring a pure spirit by distillation.



Patent granted to James Collier, *of Newman street, Oxford street, in the Parish of St. Mary-le-bone, Civil Engineer; and* Henry Pinkus, *of Thayer street, Manchester Square, in the county of Middlesex, Gentleman, for an improved method and apparatus for generating Gas for Illumination.—Dated April* 5, 1830.

The material from which the gas is to be generated consists of a proportion of one cwt. of rosin, pitch, or other bitumen, dissolved by the ordinary means, or a similar quantity of Stockholm or Archangel tar, which, being heated to a temperature of from 150° to 200° of Fah., is mixed with five to seven per cent. by weight of sugar, molasses, or other similar combustible, affording an excess of carbon. The mixture is then to be agitated till all effervescence ceases, and is then ready to be used for producing gas in the way to be described.

A cylindrical retort, divided longitudinally into three compartments, is placed in a common coke furnace, its periphery resting on friction rollers affixed to the latter. A pipe or funnel proceeds horizontally from the back of the retort, and is furnished with an elbow and stuffing box, the former dripping into a hydraulic joint, and communicating with a condenser below it. Above the retort, and parallel with it, are three generators, composed of as many pipes, which unite in one before entering at the front of the retort, and furnished with proper feed cocks. A feeding valve and governor is connected with the condenser, and communicate with the supply cocks by means of a lever.

The patentees observe, that the surfaces of the compartments, on to which the heated material is to be injected, should be covered with fragments of bricks or coke. The retort being heated to a bright cherry red, the material may be passed into the generators by means of a force pump, or by a column of the fluid of convenient length, according to the required pressure necessary to keep the generators full. When the fluid has become sufficiently heated, vent must be given at the feed cock, when it will, by its expansive force, flash off into the retort in small streams or sprays, and will fall nearly equal over the red-hot surface, and will consequently be more effectually and quickly decomposed than by the common mode of letting the fluid fall on one part of the retort, which would soon become cooled down to a black heat, and cease to decompose the material, whilst the remaining part of the retort would frequently acquire so intense a heat as to deposite much carbon. The material having absorbed caloric in its passage through the generators, will require proportionably less heat to decompose it in the retort.

By the common method of using the resinous bitumen, much inconvenience has arisen owing to the detrimental effects produced on the metal of the retorts by the development of its oxygen, and the consequent formation of acids in the retort. To obviate these injurious effects, sugar or molasses, or other similar combustibles, affording an excess of carbon, is combined with the bitumen as before described. When this compound material is subjected to a red heat, and oxygen is developed, part of the latter will unite with the excess of carbon to form carbonic acid gas, (which may be removed by purification,) and a part will unite with hydrogen to form water, which will be deposited in the condenser, and may be separated from the resinous matter by decantation.

Another method is proposed for neutralizing such effects, and consists in admitting into the retort when in action, ammoniacal gas, or hydrogen gas in excess; part of the oxygen will then unite with the hydrogen gas, or hydrogen of the ammonia, and water will be deposited as before, some nitrogen from the ammonia will appear, the metal of the retort will thus be preserved, and their power to decompose be less impaired.

The advantages contemplated in the adoption of the revolving retort for this purpose, are stated to be that, first, in a given capacity for generating, there is considerably less metal to be heated; secondly, much smaller ovens or furnaces will be required, and there will be consequently less radiating surface, a saving in fuel, and fewer condensing vessels required; but we do not confine ourselves to any particular form of retort.

The effects produced in fixed retorts, by oleaginous or carbonacious matter falling on and adhering to one surface, is of such a nature as to diminish the power to decompose and obstruct the absorption of heat; by returning the revolving retort on the friction rollers, fresh surfaces are presented to action, when the previous ones will have time in some measure to recover their former condition.

The advantages contemplated, by the combination of a feed valve with a compensating valve, or a common governor, is the regulating, by the latter, the supply of gas to the burners with more uniform pressure, and preventing the agitation or jumping of the lights caused by the sudden or unequal velocity of the gas issuing from the retort. As the gas issues from the retort it enters the feed valve, lifts one end of the lever, depresses the other, and shuts off the supply to the retort. As the gas becomes exhausted the feed valve becomes depressed, and the other end of the lever rises, opening the supply cock, when more heated material flashes into the retort.

The patentees claim as their improvement, first, the above described method of neutralizing the effects and inconveniences arising from the common manner of using the resinous bitumen, by adding to the bitumen molasses, sugar, or other similar material, which shall unite with the oxygen developed in the retort, and form compounds less detrimental; second, the means of effecting the same object by admitting into the retort, when in action, ammoniacal or hydrogen gases; third, injecting into the retort any material to be decomposed, whether by the action of a force pump, or by the expansibility of heated material; fourth, the method of heating in generators under pressure a material to be decomposed; fifth, the combination of a compensating valve or governor, in conjunction with a feed valve, but disclaiming them when uncombined or separate; and sixth, the application of a finishing purifier, when placed at the outlet valve as described.

Documents relating to the Royal Ordinances of France, (1823 and 1828,) *concerning High Pressure Steam Engines.*

[TRANSLATED FOR THIS JOURNAL.]

(Continued from page 327.)

Circular of the 16*th of July*, 1828, *to the Prefects of Departments, on the subject of the Royal Ordinances, of the* 29*th of October*, 1823, *and the* 17*th of May*, 1828, *concerning High Pressure Steam Engines.*

Sir,—On the 1st of April, 1824, and on the 19th of May, 1825, I had the honour of addressing to you two circulars, accompanied by instructions, relating to the execution of the ordinance of October 29th, 1823, (No. 637, of the Bulletin of Laws, p. 230,) concerning high pressure steam engines, or those in which the elastic force of the steam exceeds two atmospheres. The experience of four years and a half, showed the want of new regulations in relation to high pressure steam engines, and his majesty has issued a new ordinance on this subject, bearing date the 17th of May, last.

The same Board of Engineers of Mines, and of Civil Engineers, which I convened in 1823, to put in execution the ordinance of October 29th, of the same year, and which had prepared the two sets of instructions spoken of above, has drawn up a third set of instructions, for the execution of the ordinance of May 7th, 1828. These instructions were, at my instance, approved on the 12th of this month, by his excellency the Minister of the Interior.

I have the honour to transmit to you — copies of these instructions. They give, in the first place, the rules for the proof pressure to which boilers must be subjected: they point out, next, the manner in which boilers, as well as interior and exterior cylinders, must be proved; they further show the necessity of giving to boilers of rolled copper or iron, sufficient thicknesses, and the manner of determining these thicknesses, observing that much greater thicknesses in proportion to the diameter, should be given to boiler tubes, than to boilers proper; because, being surrounded by the fire, they are more exposed to oxidation. Lastly, the instructions are terminated by some details, as to the manner of proving boilers and boiler tubes.

You will find appended to these instructions: 1st, a table of thicknesses for boilers of rolled or hammered iron; 2nd, a formula and explanations, which relate to this table; 3d, formulæ relating to the proof of boilers, boiler tubes, cylinders and their jackets.

I am satisfied that the table and the formulæ will be found of easy application.

The last ordinance, that of the 7th of May, 1828, is placed at the end of the instructions.

Experiments are yet to be made, to determine exactly, the elastic force of steam at different temperatures, and the dimensions to be given to safety-valves, as well as to determine the value of new devices, which have been proposed, to insure safety; I shall communicate to you the results of these delicate and important experiments, as soon as they are completed.

I must not conclude this communication without recommending again to your attention, and to the superintending care of the Engineers of Mines and Civil works, the operation of the steam engines in your department. These operations involve human life, as well as the prosperity of the mechanic arts; and as the minor details are of importance, and may escape the memory, I beg you, as well as the engineers, to refer to the circulars of the 1st of April, 1824, and the 19th of May, 1825, and to the instructions which accompany them; to examine, again, their contents, and to satisfy yourself that those instructions are conformed to. As a knowledge of the instructions, whch I now transmit to you, is indispensable to the manufacturers of boilers and of high pressure engines, I request you to send copies to both these classes of persons, so that they may profit by the information afforded them, and conform to the directions prescribed.

I hope, further, that you will attend to the execution of the ordinance of the 7th of May, 1828, and of the instructions which I now transmit to you, and request you to advise me of the receipt of the present communication.

I have the honour to be, &c. &c.

(Signed,) Becquey,
Counsellor of State, Director General of Civil Works and Mines.

Third Set of Instructions in relation to the execution of the Royal Ordinances of the 29th of October, 1823; *and 7th of May*, 1828, *concerning High Pressure Steam Engines.*

In conformity with the third article of the Royal Ordinance of October 29th, 1823, in relation to high pressure steam engines, the boiler of every engine of this kind must be subjected, in its proof, to a pressure equal to five times the usual working pressure of the engine. This proof pressure is reduced, by the Royal Ordinance of the 7th of May, 1828, to triple the usual working pressure, for boilers made of rolled copper or of wrought iron.

Cast iron boilers will still be required to bear the proof of a quintuple pressure.

This proof pressure has reference to the bursting pressure, which is evidently equal to that produced by the tension of the steam within, diminished by one atmosphere; since the boiler is pressed on the exterior by the atmosphere. This explains why the 4th art. of the Royal Ordinance of the 7th of May, 1828, directs that the tension of the steam under which the engine is ordinarily to work, diminished by one atmosphere, should be assumed as the unit of pressure.

According to the 2nd and 3d articles of the new ordinance, boiler tubes, as well as cylinders and their jackets, will be proved by a pressure referring to the same unit. This proof pressure will be quintuple the ordinary pressure for generator-tubes and cylinders of cast iron, and only triple for those of copper or wrought iron.

The mark to be affixed, after proving, to boiler tubes and cylinders, will be regulated in the manner set forth, for boilers, in the second set of instructions, in reference to the ordinance of October 29th, 1823.

For example, suppose an engine to be run usually at a pressure of five atmospheres. The boiler, after proving, must be marked five atmospheres. The unit of pressure being five less one, or four atmospheres, this number is to be multiplied by five, if the boiler be of cast iron, or three, if of copper, or of wrought iron, to determine the proof pressure. Thus the mark five, will show that the boiler, if of cast iron, has been subjected to a proof pressure of twenty atmospheres; if of copper or wrought iron, to a proof of twelve atmospheres.

If the boiler be of cast iron, and the boiler tubes of copper, or wrought iron, these latter, although they have been subjected but to a triple pressure, are to be marked five, as well as the boiler which has borne a quintuple pressure.

Manufacturers should not be induced, by the less proof to which boilers of wrought iron, or of copper, will be subjected, to diminish the thickness now in use for such boilers. If any such diminution should be made, the consequences would be of the worst kind, and to prevent this, the first art. of the Royal Ordinance of the 7th of May, 1828, while it reduces the proof, requires such a thickness to be given to the boiler, that the resistance of the metal may not be diminished by the proof.

Experience has shown, that elastic substances, as iron or copper, cannot bear, without injury, a strain nearly equal to that producing their rupture. The same injury would occur, if boilers of those materials were too thin. It is, therefore, essential to give to a boiler such a thickness, as shall enable it to bear three times the pressure to which it is to be subjected, under the hydraulic press. If this were not the case, the proof might injure it, without, perhaps, producing any external appearances of rupture.

Manufacturers, therefore, should make their boilers too thick, rather than too thin, thus avoiding the risk of their giving way, after having stood the proof pressure.

It is proper to observe here, that the 7th article of the Royal Ordinance of October 29, 1823, requires the engineers to examine, at least once a year, every boiler; to ascertain the condition of each, and to induce the condemnation of those, which long use, or accidental deterioration, may have rendered, in their opinion, dangerous. The only means of proving a boiler, is to submit it, anew, to the action of the hydraulic press. It is, therefore, necessary that manufacturers should furnish boilers, which may, at any time, be proved without injury to them.

The thicknesses hitherto given to boilers of wrought iron, have been considered too small for the quintuple proof; they will, however, suit the triple one, and if such dimensions be preserved, boilers may be proved without injury to them.

The proper thickness for a boiler is to be determined, with relation, 1st. to the tenacity of the material to be used, allowing for the injuries to which it may be exposed; 2nd. to the diameter of the boiler; and 3d. to the bursting pressure which the boiler is to withstand. The mode of calculation is as follows: express in inches, and decimal parts of an inch, the interior diameter of the boiler, which is supposed cylindrical, with hemispherical ends, the only proper form for a high pressure boiler; multiply the diameter, thus expressed, by 18, and this product by the interior pressure (in atmospheres) less one; to this product add 1200, and divide the sum by 10,000, the quotient will give in decimal parts of an inch the thickness sought.

Let us suppose, for example, a boiler of which the interior diameter is 30 inches, and the pressure of the steam within, 5 atmospheres, required its thickness. Thirty, multiplied by 18, gives 540; this product multiplied by 5 less one, or 4, becomes 2160; 1200 added to this, gives, for a sum, 3360; this divided by 10,000, which is done by cutting off 4 figures for decimals, gives (.336) 336 thousandth parts of an inch for the thickness required. The thicknesses, given in the table annexed to the present set of instructions, were calculated in this way. It will afford the means of judging whether a boiler is thick enough to be subjected to the proof, the quality of the metal of which the boiler is made being considered separately. This table includes a variety of cases, and any thickness not found there, may be calculated by the method explained above—the formula for expressing which, will be found appended to the table.

High pressure boilers should never have a less thickness than .18 ($\frac{3}{16}$ths) of an inch; but while an insufficient thickness is to be guarded against, the opposite extreme, viz. giving too great a thickness, is equally to be avoided. Experience shows, that boilers, when very thick, are affected greatly by the action of the fire. Practical men give .56 ($\frac{9}{16}$ths) of an inch as the maximum thickness. This limit restricts the dimensions of boilers intended to supply very high steam; for example, the table appended to these instructions, shows that a boiler, bearing the stamp of eight atmospheres, cannot have a diameter greater than between 34 and 36 inches.

The preceding remarks show, that no boiler can be licensed, which is not of the thickness required by the number representing the pressure within, and by its diameter, even when such a thickness could not be given, without going beyond the prescribed *maximum*. In such a case, a mark of a lower grade must be affixed, and if the manufacturer require a boiler of the proof first intended, he must provide one of a less diameter. It must be observed, that the method, just given, for determining thicknesses, does not apply to boiler tubes. These tubes have a much greater proportional thickness given to them than to boilers, since, from their position, they are more exposed to deterioration.

If the boiler is to be made of laminated copper, the table, or formula, may still be used to determine its thickness. Manufacturers are not in the habit of giving to copper boilers thicknesses greater than those of iron boilers, of the same diameters; because, although rolled iron is more tenacious than copper, the qualities of different sheets, and even of different parts of the same sheet, are very variable, which is not the case with copper. If, however, the copper is not of good quality, one or two-tenths of the thickness given by the table, should be added to the numbers there found, for the thickness of the boiler.

The present instructions may be usefully concluded by some details upon the method of proving boilers by the hydraulic press, or forcing pump.

In proving boilers, their safety-valves should be loaded with the requisite weights; in the case of boiler tubes or cylinders, the valve of the hydraulic press must be loaded.

The requisite weight will be found as follows:

Express in inches and decimal parts of an inch, the diameter of the valve; square this number, that is, multiply it by itself. Multiply this square by 1178, and divide the product by 100, the quotient will be the number of pounds, and decimals of a pound, with which the valve is to be loaded for each atmosphere. The weight, thus found, multiplied by the required number of atmospheres of pressure, will give the proof weight. As an example, take a valve of 1.5 inches in diameter. Squaring this number gives 2.25; multiplying the square by 1178, we have 2650.50; dividing this product by 100, (removing the decimal point two places to the left, gives 26.5050 lbs. for the load upon the valve, which will balance a bursting pressure of one atmosphere.

If the proof required is twelve atmospheres, the number just found should be multiplied by 12; if 20 atmospheres, by 20. Let us suppose the latter case, the valve must then be loaded with a weight of 530.1 lbs.

In order to apply this weight by the intervention of a lever, the number just found must be multiplied by the short arm* of the lever, and the product divided by the long arm, each being expressed in inches. For example, suppose the short arm of the lever to be 2 inches, the long arm 15 inches; 530.1 must, in such a case, be multiplied by 2, and the product divided by 15; this quotient, 70.68 lbs. is the weight to be applied at the end of the long arm of the lever. If the long arm were ten times the length of the short arm of the lever, the weight to be applied would be 53.01 lbs. one-tenth of the direct weight. Such a ratio has been adopted by the principal mechanicians of Paris; it shortens calculations: its adoption in all the manufactories of steam engines, and of hydraulic presses, is recommended.

The numerical operations, which have been described, are expressed by algebraic formulæ, in the appendix to these instructions.

In conclusion, it is to be observed, that before the proof is begun, the engineer should ascertain that the valves are well made, and carefully fitted.

When a valve is defective the water is forced out in particular parts of the periphery, before the required pressure has been reached; there can be no certainty that the proof pressure has been applied, until the valve rising suddenly allows the water to escape at every point of its circumference.

---

* The short arm of the lever, is the distance from its fulcrum to the point where the lever acts upon the valve; the long arm, the distance from the fulcrum to the point of application of the weight.

Table of thicknesses to be given to Wrought Iron Boilers, for High Pressure Engines.

Diameters of Boilers.	Thicknesses in Decimals of an inch.						
	Working pressures in atmospheres.						
Inches.	2	3	4	5	6	7	8
20	.156	.192	.228	.264	.300	.336	.372
22	.160	.199	.239	.278	.318	.358	.397
24	.163	.206	.250	.293	.336	.379	.422
26	.167	.214	.260	.307	.354	.401	.448
28	.170	.221	.271	.322	.372	.422	.473
30	.174	.228	.282	.336	.390	.444	.498
32	.178	.235	.293	.350	.408	.466	.523
34	.181	.242	.304	.365	.426	.487	.548
36	.185	.250	.314	.379	.444	.509	.574
38	.188	.257	.325	.394	.462	.530	.599
40	.192	.264	.336	.408	.480	.552	.624

Formula and Explanatory Remarks referring to the foregoing Table.

The numbers in the first column of the table, are the diameters of the boilers expressed in inches. Above each succeeding column is placed the number denoting the pressure within the boiler in atmospheres, and in each column the thickness to be given to the boiler to withstand such a pressure, is stated in decimal parts of an inch.

For example, if we required the thickness which should be given to a boiler, of 30 inches diameter, to contain steam of 5 atmospheres. In the first column we find 30, and in the column headed 5, on a line with 30, the number expressing the thickness is to be found, viz .336 of an inch, or about $\frac{5}{16}$ths.

The maximum thickness for a boiler being .56 of an inch, ($\frac{9}{16}$,) as has been stated in the preceding instructions, a boiler marked 8 atmospheres must always be of a less diameter than 36 inches. The limit is 34.92 inches. A boiler, therefore, of greater diameter than this, must have a lower mark. For pressures above 8 atmospheres it is evident that the diameters must be decreased as the pressures increase.

The table gives the thicknesses of boilers having the marks of 2, 3, 4, 5, 6, 7, and 8 atmospheres, and having diameters of from 20 to 40 inches inclusive. For pressures and diameters not contained in the table, the thickness may be calculated by the following formula.

$$t=\frac{18d\,(n-1)+1200}{10{,}000}\ ^{*}$$

---

* From this formula, we derive,

$t=.0018d\,(n-1)+.12$, or $d=\frac{t-.12}{.0018\,(n-1)}$ (*a*,) and $n=\frac{t-.12}{.0018d}+1$ (*b*)

In this formula, t represents the thickness sought, d the given diameter expressed in inches, and n the number denoting the working pressure. The coefficient 18 was obtained with reference to the proof required to be sustained by the boiler, and to the relation, deduced from practice, between the pressure of one atmosphere and the tenacity of wrought iron for a given surface.

The number 1200, added to the numerator, being divided by 10,000, expresses a constant thickness of .12 of an inch, given as a minimum thickness for a boiler to contain steam of atmospheric pressure, and added to make up for the loss of tenacity which the material undergoes in bending it, by heating, or by constant wear.

Suppose given $d = 33.2$ inches, and $n = 4\frac{1}{2}$ atmospheres, we shall have

$$t = \frac{18 \times 33.2\,(4.5 - 1) + 1200}{10{,}000} = \frac{597.6 \times 3.5 + 1200}{10{,}000}$$

$$= \frac{2091.6 + 1200}{10{,}000} = 329.26 \text{ of an inch.}$$

By beginning the table at 2 atmospheres it has been rendered applicable, as far as was necessary, to low-pressure boilers. It was deemed useless to give the calculations for an atmosphere and a half, inasmuch as at this pressure, manufacturers are in the habit of giving to their boilers thicknesses greater in proportion than for higher pressures.

Formula relating to the proof of Boilers, Boiler Tubes, &c.

Let W express the weight with which a valve is to be loaded, w the weight which applied by means of a lever will produce the pressure W, each being expressed in pounds and decimals of a pound. Let d be the diameter of the valve in inches and parts of an inch; n the number denoting the working pressure, L the longer arm of the lever, to which w is attached; l the shorter arm of the same lever; m the relation between the proof pressure and the bursting pressure of the steam under which the engine works. We shall have

The formula a shows for a given pressure, the greatest diameter which can be given to a boiler, without its requiring a thickness greater than that assumed as a maximum.

If we suppose this maximum thickness to be .56 of an inch and the pressure 8 atmospheres, then $t = .56$ and $n = 8$, hence

$$d = \frac{.56 - .12}{.0018\,(8 - 1)} = \frac{.44}{.0018 \times 7} = \frac{.44}{.126} = 34.92 \text{ inches, the value already}$$

given.

The formula (b) will serve to ascertain the highest working pressure of steam which can be used in a boiler of a given diameter and thickness. For example, let $t = .44$ $d = 39.2$, we shall have

$$n = \frac{.44 - .12}{.0018 \times 39.2} + 1 = \frac{.32}{.7056} + 1 = 4.5 + 1 = 5.5$$

The supposed boiler cannot bear a higher mark that $5\frac{1}{2}$ atmospheres.

$$W = \frac{d^2 \times 1178\,(n-1)\,m}{100}, \quad \text{and} \quad w = \frac{d^2 \times 1178\,(n-1)\,m}{100} \times \frac{l}{L}\ (*)$$

If the boiler be of cast iron, m will correspond to five times the bursting pressure, or $m=5$; if of wrought iron, $m=3$.

Let us take a cast iron boiler as an example, then $m=5$. Also, let us suppose $d = 1.5$, $n = 4$, $L = 24$, and $l = 2$, we shall have for the direct load of the valve,

$$W = \frac{1.5 \times 1.5 \times 1178\,(4-1)\,5}{100} = \frac{2.25 \times 1178 \times 15}{100} = 397.57 \text{ lbs.}$$

And for the weight to be applied to the lever

$$w = 397.57 \times \frac{2}{24} = 33.13 \text{ lbs.}$$

If the boiler were of wrought iron, the other data remaining the same, $m=3$, we should then have, $W = 238.55$ lbs, and $w = 19.88$ lbs.

(Signed,) Becquey,
Counsellor of State, &c.

Approved, &c.
Paris, July 12th, 1828.

The Results of Machinery.

(Continued from page 349.)

The price of *bread*—the great staff of life—has thus we see been reduced *a full half* by the substitution of wind and water-mills for the hand-mill; but even this benefit, inestimable as it is, is exceeded in degree by what has been effected by machinery in regard to other articles more or less essential to human subsistence and comfort.

The same quantity of *coal*, which can now be obtained by the aid of machinery for eighteen pence, or one day's wages of the worst paid labourer, could not be obtained without it for a whole year's wages—(p. 347.)—that is to say, it would take a man with a mattock and shovel three hundred and thirteen working days to obtain fuel sufficient for the consumption of seven! It may, in fact, with greater truth be affirmed, that without machinery, coals could not be procured at all in any considerable quantity at any price; for of what use would it be to dig pits were there neither windlass, nor horse-gin, nor steam engine to keep them dry and raise the coals to the surface?†

---

* In the preceding remarks, the lever is considered as destitute of weight, or, which amounts to the same thing, is supposed to be balanced upon its fulcrum by a suitable counterpoise. Although the levers in practice are not thus arranged, the allowance for their weight is generally neglected. If it were deemed necessary, in any case, to consider the pressure upon the valve by the weight of the arm of the lever, it might be done by subtracting half that weight from the load at the extremity of the arm, as shown by the above formula. Calling s this weight, and w' the constant load, we shall have, if not exactly, at least nearly enough for practice, $w' = w - \frac{1}{2} s$.

† "The sufferings produced by a want of coal cannot be estimated by those who have abundance. In Normandy, at the present day, such is the scarcity of

"In all mining operations, conducted as they are in modern times, and in our own country, we must either go without the article produced, whether coal, or iron, or lead, or tin, if the machines were abolished—or we must employ human labour, in works the most painful, at a price which would not only render existence unbearable, but destroy it altogether. The people, in that case, would be in the condition of the unhappy natives of South America, when the Spaniards resolved to get gold at any cost of human suffering. The Spaniards had no machines but pickaxes and spades to put in the hands of the poor Indians. They compelled them to labour incessantly with these, and half the people were destroyed. Without machinery, in places where people can obtain even valuable ore for nothing, the collection and preparation of metals is hardly worth the labour. Mungo Parke describes the sad condition of the Africans who were always washing gold-dust;—and we have seen in Derbyshire a poor man separating small particles of lead from the soft stone, (gypsum,) of that country, and unable to earn a shilling a-day by the process. A man of capital erects lead-works, and in a year or two obtains an adequate profit, and employs many labourers.

Water is equally necessary with bread and fuel to human existence; but it is, in most parts of England, to be had in such abundance, and at so cheap a rate, that the procuring of it seldom costs even the very poorest a thought. But let us take away machinery, and see what would then be the result.

"In some cities of Spain, where the people understand very little about machinery, water, at particular periods of the year, is as dear as wine; and the labouring classes are consequently in a most miserable condition. In London, on the contrary, water is so plentiful, that 29,000,000 of gallons are daily supplied to the inhabitants; which quantity, distributed to about 125,000 houses and other buildings, is at the rate of above 200 gallons every day to each house. To many of the houses this water is, by the aid of machinery, not only delivered to the kitchens and wash-houses on the ground floors, where it is most wanted, but is sent up to the very tops of the houses, to save even the comparatively little labour of carrying it from the bottom. All this is done at an average cost to each house of about two-pence a-day; which is less price than the labour of an able-bodied man would be worth to carry a single bucket from a spring half a mile from his own dwelling.

"And how did the inhabitants of London set about getting this great supply of water? How did they get a sufficient quantity, not only to use as much as they please for drinking, for cooking, and for washing, but obtained such an abundance, that the poorest man can afford to throw it away as if it cost nothing, into the channels which

---

wood, that persons engaged in various works of hand—as lace-making by the pillow—absolutely sit up through the winter nights in the barns of the farmers, where cattle are littered down, that they may be kept warm by the animal heat which is around them. They sleep in the day, and are warmed by being in the same out-house with cows and horses at night; and thus they work under every disadvantage because fuel is scarce and very dear."

are also provided for carrying it off, and thus to free his own room or house from every impurity; and by so doing to render this vast place one of the most healthful cities in the world? They set about doing this great work by machinery; and they began to do it when the value of machinery in other things was not so well understood as it is now. As long ago as the year 1236, when a great want of water was felt in London, the little springs being blocked up and covered over by buildings, the ruling men of the city caused water to be brought from Tyburn, which was then a distant village, by means of pipes; and they laid a tax upon particular branches of trade, to pay the expense of this great blessing to all. In succeeding times more pipes and conduits, that is, more machinery, was established for the same good purpose; and two centuries afterwards, king Henry the Sixth gave his aid to the same sort of works, in granting particular advantages in obtaining lead for making the pipes. The reason for this aid to such works was, as the royal decree set forth, that they were 'for the common utility and decency of all the city, and *for the universal advantage;*' and a very true reason this was. As this great town more and more increased, more water-works were found necessary; till at last in the reign of James the First, which was nearly 200 years after that of Henry the Sixth, a most ingenious and enterprising man, and a great benefactor to his country, Hugh Myddleton, undertook to bring a river of pure water above 38 miles out of its natural course for the supply of London. He persevered in this immense undertaking, in spite of every difficulty, till he at last accomplished that great good which he had proposed, of bringing wholesome water to every man's door. At the present time the New River, which was the work of Hugh Myddleton, supplies 13,000,000 of gallons of water every day; and though the original projector was ruined by the undertaking, in consequence of the difficulty which he had in procuring proper support, such is now the general advantage of the benefit which he procured for his fellow-citizens, and so desirable are the people to possess that advantage, that a share in the New River Company, which was at first sold at £100, is now worth £15,000.

"Before the people of London had water brought to their own doors, and even into their very houses, and into every room of their houses where it is desirable to bring it, they were obliged to send for this great article of life—first, to the few springs which were found in the city and its neighbourhood, and, secondly, to the conduits and fountains, which were imperfect mechanical contrivances for bringing it. The service pipes to each house are more perfect mechanical contrivances; but they could not have been rendered so perfect without engines, which force the water above the level of the source from which it is taken. When the inhabitants brought their water from the springs and conduits there was a great deal of human labour employed; and as in every large community there are always people ready to perform labour for money, many persons obtained a living by carrying water. When the New River had been dug, and the pipes had been laid down, and the engines had been set up, it is perfectly clear that there would have been no further need for these water carriers. When the people of London could obtain 200 gallons of water for two pence, they would not employ a man to fetch a single bucket from the river or the fountain at the same price. They would not, for the mere love of employing human labour directly, continue to buy an article very dear, which, by mechanical aid, they could buy very cheap. If they had resolved, from any mistaken notions about machinery, to continue to employ the water-carriers, they must have been contented with 1 gallon of water a-day instead of 200 gallons. Or if they had consumed a larger quantity, and continued to pay the price of bringing it to them by hand, they must have denied themselves other necessaries and comforts. They must have gone without a certain portion of food, or clothing, or fuel, which they are now enabled to obtain by the saving in the article of water. To have had for each house 200 gallons of water, and in having this 200 gallons of water, to have had the cleanliness and health which result from its use, would have been utterly impossible. At two pence a gallon, which would not have been a large price considering the distances to which it must have been carried, the same supply of water would have cost about £9,000,000 sterling a-year, and would have employed, at the wages of two shillings a-day, more than one-half of all the present inhabitants of London, or 800,000 people, that is, about four times the number of able-bodied men altogether contained in the metropolis. Such a supply, therefore, would have been utterly out of the question. To have supplied 1 gallon instead of 200 gallons to each house at the same rate of wages, would have required the labour of 12,000 men. It is evident that even this number could not have been employed in such an office; because had there been no means of supplying London with water but the means of human hands, London could not have increased to one-twentieth of its present size;—there would not have been one-twentieth part of the population to have been supplied—and therefore 600 water-carriers would have been an ample proportion to this population."

The example just quoted is the more deserving of attention that among the instances of popular absurdity which have disgraced the year 1830, there has been actually one of a number of water-carriers combining to prevent, by intimidation, the extension to the city of Exeter of the same benefit from water-supplying machinery, which have been enjoyed, for centuries past, by the inhabitants of the metropolis.

The author next invites the attention of his readers to the influence of machinery in reducing the price of *clothing*. His first example is drawn from the manufacture of cotton. At the time Arkwright introduced spinning by machinery, the price of a particular sort of cotton yarn, (much used in the manufacture of calico,) was thirty-eight shillings a pound—now it costs only between three and four shillings; cottons sold then at six shillings a yard—now they average scarcely sixpence. The total annual value of the cotton manufacture did not then exceed £200,000; at present it amounts to

£36,000,000. Of the cotton cloth now made in England, about four hundred millions of yards are retained for home consumption; which, taking the population at twenty-five millions, allows sixteen yards each for every individual; eighty years ago, not one person in thirty had even a single yard to his share. In fact, although cotton stuffs were always cheaper than silk, (which was anciently sold for its weight in gold,) they were still, at the time of Arkwright, so costly as only to be purchased by the most opulent.

"The invention of Arkwright—the substitution of rollers for fingers, changed the commerce of the world. The machinery by which a man, a woman, or even a child, could produce two hundred threads where one was produced before, caused a cheapness of production much greater than that of India, where human labour is scarcely worth any thing. * * * The trade in India cotton goods is hence gone for ever. Not even the caprices of fashion can have an excuse for purchasing the dearer commodity. We make it cheaper and we make it better. The trade in cotton, as it exists in the present day, is the great triumph of human ingenuity. We bring the raw material from the country of the people who grow it, on the other side of our globe; we manufacture it by our machines into articles which we used to buy from them ready made; and taking back those articles to their own markets, encumbered with the cost of transport for fourteen thousand miles, and encumbered also with the taxes which the State has laid upon it in many various ways, we sell it to these very people cheaper than they can produce it themselves, and they buy it, therefore, with eagerness."

* * * * *

"Nor is the creation of employment amongst ourselves by the cheapness of cotton goods produced by machinery, to be considered as a mere change from the labour of India to the labour of England. It is a creation of employment operating just in the same manner as the machinery did for printing books. The Indian, it is true, no longer sends us his calicoes and his coloured stuffs; we make them ourselves. But he sends us forty times the amount of raw cotton that he sent when the machinery was first set up. In 1781 we imported five million pounds of cotton wool. In 1828 we imported two hundred and ten million pounds—enough to make twelve hundred and sixty million yards of cloth—which is about two yards a piece for every human being in the world. The workman on the banks of the Ganges, (the great river of India,) is no longer weaving calicoes for us, in his loom of reeds under the shade of a mango tree; but he is gathering for us forty times as much cotton as he gathered before, and making forty times as much indigo for us to colour it with. The export of cotton has made such a demand upon the Indian power of labour, that even the people of Hindostan, adopting European contrivances, have introduced machinery to pack the cotton. Bishop Heber says, that he was frequently interested by seeing, at Bombay, immense bales of cotton laying on the piers, and the ingenious screw, by which an astonishing quantity is pressed into the canvass bags. The Chinese, on the contrary, from the want of these contrivances, sell their cotton to us at much less profit; for they pack it so loosely that it occupies three times the bulk of the Indian cotton, and the freight costs twelve times the price to which it might be reduced by mechanical skill."

Another striking instance of an important article of apparel, depending almost entirely on machinery for its general introduction, is furnished by the history of the stocking manufacture.

"Before the invention of the first stocking-machine, in the year 1589, by William Lea, a clergyman, none but the very rich wore stockings, and many of the most wealthy went without stockings at all, their hose being sewn together by the tailor, or their legs being covered with bandages of cloth. William Lea made a pair of stockings by the frame in the presence of King James I.; but such was the prejudice of those times, that he could get no encouragement for his invention. His invention was discountenanced, upon the plea that it would deprive the industrious poor of their subsistence. He went to France, where he met with no better success; and died at last of a broken heart. The great then *could* discountenance an invention because its application was limited to themselves. *They* only wore stockings; the poor who made them had none to wear. Stockings were not cheap enough for the poor to wear, and therefore they went without. Of the millions of people now in this country, how few are without stockings! What a miserable exception to the comforts of the rest of the people does it appear to you when you see a beggar in the streets without stockings! You consider such a person to be in the lowest stages of want and suffering. Two centuries ago, not one person in a thousand wore stockings; one century ago, not one person in five hundred wore them; now, not one person in a thousand is without them. Who made this great change in the condition of the people of England, and indeed, of the people of almost all civilized countries? William Lea—who died at Paris of a broken heart. And why did he die of grief and penury? Because the people of his own days were too ignorant to accept the blessings he had prepared for them."

Not content with thus establishing the truth of his general position, by examples drawn from articles of necessity, the author goes on to show some very curious effects of machinery in the production of articles, which, though trifling in themselves, are in such general use, that the want of them would be felt as a severe privation.

"There is an article employed in dress, which is at once so necessary and so beautiful that the highest lady in the land uses it, and yet so cheap, that the poorest peasant's wife is enabled to procure it. The quality of the article is as perfect as art can make it; and yet from the enormous quantities consumed by the great mass of the people, it is made so cheap that the poor can purchase the best kind as well as the rich. It is an article of universal use. United with machinery, many hundreds, and even thousands, are employed in making it. But if the machinery were to stop, and the article were made by human hands alone, it would become so dear that the richest only could afford to use it; and it would become, at the same time, so rough in its appearance, that those very rich would be ashamed of using it. The article we mean is a pin."

* * * * *

"Needles are not so cheap as pins, because the material of which they are made is more expensive, and the processes cannot be executed so completely by machinery. But without machinery how could that most beautiful article, a *fine* needle, be sold at the rate of six for a penny? As in the case of pins, machinery is at work at the first formation of the material. Without the tilt-hammer, which beats out the bar of steel, first at the rate of ten strokes a minute, and lastly at that of 500, how could that bar be prepared for needle-making at any thing like a reasonable price? In all the processes of needle-making, labour is saved by contrivance and machinery. What human touch would be exquisite enough to make the eye of the finest needle, through which the most delicate silk is with difficulty passed? Needles are made in such large quantites, that it is even important to save the time of the child who lays them all one way when they are completed. Mr. Babbage, who is equally distinguished for his profound science, and his mechanical ingenuity, has described this process as an example of one of the simplest contrivances which can come under the denomination of a tool."

On the Effects of different Arts and Trades on Health and Longevity; abstracted from a work on that subject, relating particularly to the Manufactories of Leeds, in England, written by C. TURNER THACKRAH.

AFTER a series of interesting remarks and calculations, founded no authentic data, Mr. Thackrah says—

"Taking, then, the mortality at Pickering Lythe as the natural one, there was an excess of 321 deaths in the borough of Leeds during the year 1821. And allowing for the increase of population since that period, we may fairly say that at least 450 persons die annually in the borough of Leeds, from the injurious effects of manufactures, the crowded state of population, and the consequent bad habits of life. We may say that every day of the year is carried to the grave the corpse of an individual whom nature would have long preserved in health and vigour;—every day we see sacrificed to the artificial state of society, one, and sometimes two victims, whom the destinies of nature would have spared. The destruction of 450 persons year by year in the borough of Leeds cannot be considered by any benevolent mind as an insignificant affair. Still less can the impaired health, the lingering ailments, the premature decay, mental and corporeal, of nine-tenths of the survivers, be a subject of indifference. Assuredly an examination into the state of our manufactures has long been demanded, alike by humanity and by science. The object of this paper is to excite public attention to the subject. Myself and my pupils have personally and carefully inspected the state of the artisans in most kinds of manufacture, examined the agencies believed to be injurious, conversed on the subject with masters, overlookers, and the more intelligent workmen, and obtained many tables illustrating the character of the disorders prevalent in the several kinds of employ. From these sources collectively, I have drawn up statements, which, though avowedly imperfect, must, I conceive, approach to the truth."

Mr. Thackrah then goes into his striking details, dividing, for that purpose, the population into four great classes of operatives, dealers, master-manufacturers and merchants, and professional men; and examining "the atmosphere they breathe—the muscular exercise they take—the posture of the body they maintain—the variations of temperature and humidity to which they are exposed—their diet and habits of life; and finally, in some classes, their state of mind." We will display some of the results in almost a tabular form.

OUT OF DOORS.

"*Butchers*, and the slaughtermen, their wives and their errand-boys, almost all eat fresh-cooked meat at least twice a-day. They are plump and rosy. They are generally, also, cheerful and good-natured. Neither does their bloody occupation, nor their beef-eating, render them savage, as some theorists pretend, and even as the English law presumes. They are not subject to such anxieties as the fluctuations of other trades produce—for meat is always in request; and butchers live comfortably in times as well of general distress as of general prosperity. They are subject to few ailments, and these the result of plethora." Though more free from diseases than other trades, they, however, do not enjoy greater longevity; on the contrary, Mr. T. thinks their lives shorter than those of other men who spend much time in the open air.*

Cattle and horse dealers are generally healthy, except when their habits are intemperate.

---

* "Butchers, (he says,) in fact live too highly—not too highly for temporary health, but too highly for long life. Is every man gifted at birth with a portion of the pabulum of life, which he cannot increase, but which he may prematurely consume;—in other words, does nature endow us with a vital patrimony, which we may exhaust, not only by profligate indulgence, but even by regular draughts too frequently repeated? Or rather, does not high living, (for I speak not at present of excess or intemperance,)—does not high living produce that plethoric state which gradually leads to disease? I believe the latter. Congestion of blood, affecting chiefly the vessels of the abdomen and head, shortens the lives of numbers who are plump, rosy, and apparently strong. My very intelligent friend, Dr. Murray, of Scarborough;" he adds, "concurs in the statement relative to butchers. 'The high living of butchers assuredly leads to plethora and premature dissolution.' He adds—'Thus coal-meters, &c. of London, rarely, if every, attain the age of forty, though men remarkable for muscular bulk and strength. They work most laboriously, perspire immensely, and supply such waste by extraordinary and almost incredible potations of porter, which ultimately, without much positive and actual intemperance, brings on irregularities of the digestive system, structural changes, and death.' "

Fishmongers, though much exposed to the weather, are hardy, temperate, healthy, and long lived.

Cart-drivers, if sufficiently fed and temperate, the same.

Labourers in husbandry, &c. suffer from a deficiency of nourishment.

Brickmakers, with full muscular exercise in the open air, though exposed to vicissitudes of cold and wet, avoid rheumatism and inflammatory diseases, and attain good old age.

Chaise-drivers, postilions, coachmen, guards, &c. from the position of the two former on the saddle, irregular living, &c. and from the want of muscular exercise in the two latter, are subject to gastric disorders, and, finally, apoplexy and palsy, which shorten their lives."

Carpenters, Coopers, Wheelwrights, &c. healthy and long lived.

Smiths, often intemperate, and die comparatively young.

Rope makers and gardeners suffer from their stooping postures.

Paviers, subject to complaints in the loins, increasing with age, but they live long.

IN-DOOR OCCUPATIONS.

Tailors,[*] notwithstanding their confined atmosphere and bad posture, are not liable to acute diseases, but give way to stomach complaints and consumption. "It is apparent, even from observing only the expression of countenance, the complexion, and the gait, that the functions of the stomach and the heart are greatly impaired, even in those who consider themselves well. We see no plump and rosy tailors; none of fine form and strong muscle. The spine is generally curved: the reduction in the circumference of the chest is not so much as we might expect; the average of our measurements presented 33 to 34 inches, while that of other artisans is about 36. The capacity of the lungs, as evinced by measuring the air thrown out at an expiration, is not less than common: the average of six individuals was 7⅔ pints. The prejudicial influence of their employ is more insidious than urgent—it undermines rather than destroys life. * * * Of twenty-two of the workmen employed in Leeds, not one had attained the age of sixty; two had passed fifty; and of the rest not more than two had reached forty. We heard of an instance or two of great age; but the individuals had lived chiefly in the country."

Staymakers have their health impaired, but live to a good average.

Milliners, dress-makers, and straw-bonnet-makers, are unhealthy and short lived.

Spinners, cloth-dressers, weavers, &c. &c. are more or less healthy as they have exercise and air. Those exposed to inhale imperceptible particles of dressings, &c., such as frizers, suffer from disease, and are soonest cut off.

---

[*] On the bent postures, which Mr. T. considers so injurious, we may remark, that a French physiologist has just published a memoir, in proof that the spinal marrow has, properly speaking, no special action upon the circulation distinct from the general action of nervous centres, and that it is not in it that the essential principle, still less the exclusive principle of the circulation resides.

Shoemakers are placed in a bad posture:—"Digestion and circulation are so much impaired, that the countenance would mark a shoemaker almost as well as a tailor. We suppose that, from the reduction of perspiration and other evacuations, in this and similar employments, the blood is impure, and consequently the complexion darkened. The secretion of bile is generally unhealthy, and bowel complaints are frequent. The capacity of the lungs, in the individuals examined, we found to average six and one-third, and the circumference of the chest thirty-five inches. In the few shoemakers who live to old age, there is always a remarkable hollow at the base of the breast bone, occasioned by the pressure of the last."

Curriers and leather dressers are very healthy and live to old age.

Saddlers lean much forward and suffer accordingly from headach and indigestion.

Printers, (our worthy co-operators,) "are kept in a confined atmosphere, and generally want exercise. Pressmen, however, have good and varied labour. Compositors are often subject to injury from the types. These, a compound of lead and antimony, emit, when heated, a fume which affects respiration, and are said also to produce partial palsy of the hands. Among the printers, however, of whom we have inquired, care is generally taken to avoid composing till the types are cold, and thus no injury is sustained. The constant application of the eyes to minute objects gradually enfeebles these organs. The standing posture long maintained here, as well as in other occupations, tends to injure the digestive organs. Some printers complain of disorder of the stomach and head; and few appear to enjoy full health. Consumption is frequent. We can scarcely find or hear of any compositor above the age of fifty. In many towns printers are intemperate."

Bookbinders—a healthy employment.

Carvers and gilders look pale and weakly, but their lives are not abbreviated in a marked degree.

Clockmakers, generally healthy and long lived.

Watchmakers, the reverse.

House-servants, in large, smoky towns, unhealthy.

Colliers and well-sinkers, a class by themselves, seldom reach the age of fifty.

EMPLOYMENTS PRODUCING DUST, ODOUR, OR GASEOUS EXHALATIONS.

If from animal substances not injurious; nor from the vapours of wine or spirits.

Tobacco manufacturers do not appear to suffer from the floating poison in their atmosphere.

Snuff-making is more pernicious.

Men in oil-mills, generally healthy.

Brushmakers live to a very great age.

Grooms and hostlers inspire ammoniacal gas, and are robust, healthy, and long lived.

Glue and size boilers, exposed to the most noxious stench, are fresh looking and robust.

Tallow-chandlers, also exposed to offensive animal odour, attain considerable age.*

Tanners, remarkably strong, and exempt from consumption.

Corn-millers, breathing an atmosphere loaded with flour, are pale and sickly: very rarely attain old age.

Maltsters cannot live long, and must leave the trade in middle life.

Tea-men suffer from the dust, especially of green tees; but the injury is not permanent.

Coffee-roasters become asthmatic, and subject to headach and indigestion.

Paper-makers, when aged, cannot endure the effect of the dust from cutting the rags. The author suggests the use of machinery in this process. In the wet, and wear, and tear of the mills, they are not seriously affected, but live long.

Masons are short lived, dying generally before forty. They inhale particles of sand and dust, lift heavy weights, and are too often intemperate.

Miners die prematurely.†

Machine makers "seem to suffer only from the dust they inhale, and the consequent bronchial irritation. The *filers*, (iron,) are almost all unhealthy men, and remarkably short lived."

Founders, (in brass,) suffer from the inhalation of the volatilized metal. In the founding of *yellow* brass, in particular, the evolution of oxide of zinc is very great." They seldom reach forty years.

Copper-smiths "are considerably affected by the fine scales which rise from the imperfectly volatilized metal, and by the fumes of the 'spelter,' or solder of brass." The men are generally unhealthy, suffering from disorders similar to those of the brass founders.

"*Tinplate-workers* are subjected to fumes from muriate of ammonia, and sulphurous exhalations from the coke which they burn. These exhalations, however, appear to be annoying rather than injurious; as the men are tolerably healthy, and live to a considerable age. *Tinners* also are subject only to temporary inconvenience from the fumes of the soldering.

"*Plumbers* are exposed to the volatilized oxide of lead, which rises during the process of 'casting.'" They are sickly in appearance, and short lived.

House-painters are unhealthy, and do not generally attain full age.

---

*"During the plague in London it was remarked that this class of men suffered much less than others."

†"Last year there was in the village of Arkendale, (in the heart of the mining district,) not less than thirty widows under thirty years of age. The prevalent maladies appear to be affections of the lungs and bowels. Smelting is considered a most fatal occupation. The appearance of the men is haggard in the extreme.

Chemists and druggists, in laboratories are sickly and consumptive.

Potters, affected through the pores of the skin become paralytic, and are remarkably subject to constipation.

Hatters, grocers, bakers, and chimney sweepers, (a droll association,) also suffer through the skin; but though the irritation occasions diseases, they are not, except in the last class, fatal.

Dyers are healthy and long lived.

Brewers are, as a body, far from healthy. "Under a robust and often florid appearance, they conceal chronic diseases of the abdomen, particularly a congested state of the veinous system. When these men are accidentally hurt or wounded, they are more liable than other individuals to severe and dangerous effects."*

Cooks and confectioners "are subjected to considerable heat. Our common cooks are more unhealthy than housemaids. Their digestive organs are frequently disordered, they are subject to headache, and their tempers rendered irritable."

Glass workers are healthy; *glass blowers* often die suddenly.

New Process of Distillation.

We have occasion to call the attention of our readers to what will probably be deemed one of the most curious discoveries that has been effected in the useful arts during the present century,—that of procuring alcohol, or ardent spirit, from fermented paste, such as is commonly used for making baker's bread; in lieu of making an extract of malt or corn, for the especial purpose of raising a vinous fermentation, as now practised by the corn distillers. This important discovery has been made by Mr. Robert Hicks, a gentleman in the medical profession, who, we understand, has just taken out a patent for the invention.

As nearly all vegetable substances capable of undergoing the vinous fermentation are known to give out a certain portion of aroma, in conjunction with the carbonic acid gas evolved by the process, it might have been inferred, *á priori*, that at least a portion of such vapour contained gaseous alcohol. But the discovery of this fact, obvious as it may appear when once announced, has hitherto been overlooked, notwithstanding the profound discoveries which have been made in almost every department of chemical science during the last thirty years. The only doubt we entertained on the question, on hearing of this discovery, was, as to the practicability of obtaining spirit in any quantity worthy of notice, from the vapour of fermented paste, and sufficiently pure for the purposes of the rectifier. Previous to offering any notice of this important invention, therefore, we took the trouble of investigating its nature, and of tasting a sample of the spirit which had been produced from the condensed vapour given off during the process of baking. The specimen we tasted served at once to satisfy us of the practicability of the process on a large scale. The sample (which appeared to be nearly the strength of proof spirit) was certainly destitute both of that empyreumatic flavour, which might have been in some measure expected from a species of *dry* distillation, like that of the baking process; while it was equally free from any fetid or unpleasant odour, such as would be supposed to result from imperfect fermentation. We should say that the spirit we tasted had a slight acidulous or ether-like quality, by no means unpleasant to the palate, but which may probably be quite got rid of by subsequent rectification. It is needless to state that it was also perfectly free from colouring matter, and apparently applicable to the most delicate purposes of the rectifiers and compounders of British spirits.

---

* "The ill health of brewers is, however, evidently attributed to their habitual and unnecessary potation of beer. There is no reason to believe them injured by their employ."

In the absence of any drawing or plate to illustrate the invention of Mr. Hicks, we shall endeavour to give such a description of the new baker's oven and distilling apparatus, as may perhaps render the invention intelligible to the majority of our readers.

The body of the oven, instead of being constructed of brick-work, is formed of iron plate, and made of a circular figure, having a coating of brick or tile for receiving the loaves, when prepared of the usual sponge or dough. This oven is supported upon hollow brick-work beneath, with a space round the sides and top, sufficient to allow the play of the flame or heated air from the fire below. About a foot beneath the bottom of the oven is a circular iron plate, of the same diameter with itself, on which rests the grate or fire-chamber, with openings for the ashes to fall through into the ash-pit beneath. This circular platform is affixed to, and made to revolve on, a vertical axis, furnished with a bevel wheel, which communicates with another bevel wheel fixed on the end of a horizontal shaft; the exterior end of which shaft is provided with a winch, to enable the platform to be kept in motion by the hand, or any other moving power that may be judged necessary. The object of applying this machinery is to keep the action of the fire uniformly distributed beneath the bottom and round the sides of the oven. But in addition to this desirable point, we are informed that a very great saving of fuel is effected, as compared with the quantity required to heat an oven of the same capacity by the common brick flues. Indeed, when we take in view the rapid conducting power of metal compared with brick-work, nearly the whole effect of the fuel must be rendered available for the double process of baking and distillation. In order to prevent any escape of the heated air or flame, the edges of the circular platform are bent downwards, and made to work in a narrow trough of water, forming what may be called a water-joint.

From the upper portion of the oven, a large chamber or pipe receives the vapour evolved from the baking process, and carries it onwards through a pipe and worm-tub, or refrigerator, as in the usual process of distillation. This vapour from the bread contains a quantity of carbonic acid gas, combined with the alcohol vapour; but the latter becomes condensed into the *liquid* form; while the former flies off in the gaseous state, from the recipient containing the spirit.

The upper portion of the oven also contains a most ingenious contrivance for regulating the temperature of the whole process with the utmost precision. An iron tube, containing a quantity of oil, has a thermometer immersed in it, and is so contrived as to lower down into the body of the oven, and to be withdrawn at pleasure; thus preventing the possibility of the oven being overheated sufficiently to scorch the bread, or impart a disagreeable flavour to the spirit. The operative portion of this compound process seems to us to be provided for in a manner so as to leave little, if any thing, to be desired.

The practical application of this important discovery may lead to results which cannot at present be anticipated. Without offering any opinion as to the benefit to the community of the extensive consumption of ardent spirit, there can be no manner of doubt that, if it be a benefit, the more cheaply it can be procured, the greater will be the advantage in an economical point of view. If that which has hitherto been deemed a worthless vapour, can be now converted into a valuable product, as an article of almost universal consumption, the discovery must, at all events, be deemed one of great importance in civil economy, and calculated to enhance, in a very eminent degree, our national reputation for improvements in the several departments of the useful arts. How far the discovery of Mr. Hicks may be found to militate against the interests of persons at present connected with distillation from corn, it is not our business to inquire. Neither is it necessary to investigate the position in which the patentee may stand with regard to the present excise regulations relative to the distillation from grain. But the merits of the discovery can be in nowise prejudged, as a scientific process, by the influence it may exercise on any question of manufacturing speculation. With regard to the influence it may have indirectly upon the agricultural interests of the country, from a considerable diminution of the consumption of grain, we are not enabled at present to form any estimate. It will assuredly tend to diminish the enormous consumption of barley at present required for the use of the corn distillers; but when it is considered that the growth of barley in this country is not adequate to such consumption, and that a considerable sum in specie is annually paid to the foreign agriculturist for the importation of grain, without the smallest return being made as a compensation to our manufacturing interests; it is doubtful whether the English agriculturist would eventually suffer by the general introduction of this invention for saving the consumption of grain in the process of distilling. Another important saving will be effected in the consumption of fuel at present used for distillation, which forms so large a portion of the outlay required in this extensive branch of manufacture. We have heard it stated, (but almost deem it incredible,) that the sponge necessary to form the peck loaf is capable of yielding three ounces, imperial measure, of proof spirit during the operation of baking, and without prolonging the process beyond the ordinary time for baking the quartern loaf. It is also stated, that the bread baked by this new oven is superior in quality, and more porous in texture, than that baked in the usual way, from the vapours being carried off as fast as they are generated by the new patent oven, while a great portion may be presumed to be again condensed and incorporated with the bread by the old process. The invention in a variety of respects, will be likely to excite no ordinary attention in the public mind, the moment it is reduced to practice. [*Literary Gazette.*

Meteorological Observations for May, 1831.

Moon.	Days.	Therm.		Barometer.		Dew point	Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2, P.M.		Direction.	Force.		
				Inches	Inches.				Inches.	
	1	47°	57°	29.45	29.45	44	NW. W.	Moderate.		Cloudy day.
	2	46	62	.45	.45	44	W. W.	do.		Cloudy day.
	3	54	72	.56	.56	46	S. S.	do.		Clear day.
☾	4	58	64	.50	.50	45	W. W.	Blustering.	.2.	Rain—Flying clouds.
	5	44	66	.70	.70	42	W. W.	Moderate.		Clear day.
	6	41	64	.83	.90	42	NW. W.	do.		Clear—cloudy.
	7	46	67	.80	.70	42½	W. S.	do.		Cloudy day.
	8	48	55	.34	.30	49	E. W.	do.	.75	Cl'dy—rain—flying cl'ds.
	9	42	55	.35	.44	33	W. W.	Blustering.		Cloudy—flying clouds.
	10	37	59	.70	.74	38	W. W.	Moderate.		Ice—clear day.
⊗	11	44	73	.85	.90	56	SW. W.	do.		Clear day.
	12	54	78	.95	30.05	58	S. S.	do.		Overcast—clear.
	13	55	76	30.10	.10	59	S. S.	do.		Clear day.
	14	57	76	.14	.14	51	S. S.	do.		Clear day.
	15	56	74	.14	.14	60	E. E.	do.		Cloudy—clear.
	16	56	73	.04	.01	62	SE. SE.	do.		Drizzle---cloudy.
	17	62	78	29.95	.95	60½	E. SW.	do.		Drizzle—clear.
☽	18	59	80	.90	.90	64½	SE. SE.	do.		Foggy—flying clouds.
	19	62	80	.80	.80	65	SE. SE.	Blustering.	.12	Rain—flying clouds.
	20	64	75	.70	.70	51	SW. W.	Moderate.		Cloudy—clear.
	21	59	74	.80	.80	54	SW. W.	do.	.3	Flying cl'ds—slight shw'r.
	22	57	79	.80	.80	52	S. S.	Blustering.	.2	Clear day—rain in night.
	23	50	76	.80	.80	42	NW. W.	Moderate.		Clear—cloudy.
	24	53	57	.75	.75	48	W. NE.	do.	.2	Cloudy—rain.
	25	54	70	.60	.60	53	W. W.	do.	.30	Cloudy—flying clouds.
🌕	26	54	61	.60	.60	53	W. W.	do.		Clear—hail—rain
	27	51	67	.50	.55	54	W. W.	do.	.7	Clear—shower—clear.
	28	59	77	.68	.70	59	W. W.	do.		Clear day.
	29	60	87	.90	.94	64	W. W.	do.		Clear day.
	30	66	69	.94	.94	63	W. W.	do.		Clear day.
	31	67	92	.94	.95	52	W. W.	do.		Clear day.
	Mean	53.61	71.39	29.76	29.77	52			1.33	In. of rain in the month.

		Thermometer.	Barometer.
Maximum height during the month,		92. on the 31st	30.14 on 14th & 15th.
Minimum	do.	37. on the 10th,	29.30 on the 8th.
Mean	do.	62.50	29.765

INDEX.

A

PAGE

American flour, on the souring of - - - - - - 102

AMERICAN PATENTS, LIST OF, WITH EDITOR'S REMARKS, &c.

October, 1830—*continued.*

44. Smut and hulling machine,	Jeremiah Cose,	1
45. Pepper and ink tops,	William Markland,	ib.
46. Thrashing machine,	William Ottinger,	2
47. Hair mattresses,	Wm. F. Phyfe,	ib.
48. Rotary steam-engine,	Thomas Powell,	ib.
49. Rocks, drilling and blasting	John W. Post,	3
50. Straw cutting machine,	Titus Preston,	ib.
51. Propelling vessels,	Felix Peltier,	4
52. Raising water, machine for	Luman Parmelee,	ib.
53. Cotton twine, machine for	Thomas Rice,	ib.
54. Explosion in boilers, preventing	A. B. Quinby,	5
55. Columns, reeding and fluting machine,	Robert Thompson,	ib.
56. Piano Forte, action improved	Jesse Thompson,	ib.
57. Hat bodies, manufacturing	Henry Tenny,	6
58. Bricks, preparing clay for	J. G. Falcott,	ib.
59. Churn, double dasher	William Sutton,	ib.
60. Raising water and acquiring power,	Theophilus Somerby	7
61. Mortising and boring machinery,	Marcellus Sands,	ib.
62. Baking iron,	Elijah Skinner,	ib.
63. Thrashing and winnowing machine,	Samuel Slater,	ib.
64. Weaver's reeds, straightening splits for	Jacob Senneff,	8
65. Thrashing machine,	William Sperry,	ib.
66. Power to propel machines, applying	Augustus Sawyer,	ib.
67. Carding machine,	Uriel Warner,	9
68. Water wheel for mills,	Clark Willson,	ib.
69. Thrashing machine,	W. J. Wood,	ib.
70. Saw mill, improved	Joseph Newton,	10
71. Stock for gentlemen's wear,	Denison Williams,	ib.
72. Grain cleaning machine,	Michael Urffer,	ib.
73. Hemp and flax dresser,	Thaddeus Fairbanks,	11
74. Churn,	Ebenezer Deevey,	ib.
75. Tobacco, drying and curing	D. G. Tuck,	ib.
76. Buttons, cast wire eyed	T. Festus,	ib.
77. Iron, manufacturing,	Thomas C. Lewis,	12
78. Cotton whipper,	James S. Simmons,	ib.
79. Combs, manufacturing	J. Pitts, C. Houghton, and J. Rice,	ib.
80. Churn,	S. M. Parsons,	13

		PAGE
81. Car, receiver for rail-roads	Jonathan Crane,	13
82. Spinning machine,	W. C. Pultney,	14
83. Printing press, improved	Isaac Adams,	ib.
84. Separating machine for flour and powder,	Benjamin Culver,	ib.
85. Saw and grist mills,	William Prim,	15
86. Springs for carriages,	J. Ives and J. Walters,	ib.
87. Carriage hubs, bands for	S. K. Miller,	ib.
88. Stave dressing machinery,	W. T. Pomfrett,	16
89. Locomotive carriages,	William Heston,	ib.
90. Bedsteads for invalids,	David Bancroft,	ib.
91. Steam engines for navigation,	F. G. Smith,	73
92. Pine apple cheese, pressing	M. Norton,	ib.
93. Fancy card for carding machine,	Phineas L. King,	74
94. Washing machine,	John Freeman,	ib.
95. Steam washer,	James Barnes,	ib.
96. Sawing felloes,	Alvan Colbry,	ib.
97. Saw set,	Ebenezer Whiting,	75
98. Spreading lime, &c. on land,	A. Krauss and J. Krauss,	ib.
99. Washing machine,	W. H. Brainard and C. B. Bulkley,	ib.
100. Materials to burn in lamps,	Isaiah Jennings,	ib.
101. Grist mill,	Ephraim Griswold,	76
102. Glass door knobs,	Deming Jarvis,	77
103. Oil from sunflower,	C. A. Barnitz,	ib.
104. Brads, making from iron plates	Edmund Gamman,	ib.
105. Thrashing, shelling, grinding, &c. machine,	B. D. Beecher,	ib.
106. Sawing felloes,	D. D. Hanson,	78
107. Water wheel,	Henry Overvill,	ib.
108. Wool carding machine,	Calvin Wing,	ib.
109. Water wheel, casting	Calvin Wing,	ib.
110. Boring for water,	W. Morris and J. Spinks,	79
111. Water wheels,	Calvin Wing,	ib.
112. Bedsteads for invalids,	Jonathan Lowe,	ib.
113. Inking apparatus,	Samuel Fairlamb,	80
November.		
1. Picking apples from the ground,	Samuel Laning,	80
2. Boring for water,	Levi Disbrow,	ib.
3. Cutting tenons on spokes,	A. P. Smith,	ib.
4. Lever press,	H. Sherman,	81
5. Wool carding machine,	Charles Atwood,	ib.
6. Winding, slubbing or roving,	Charles Atwood,	ib.
7. Moulding and drying bricks,	Charles Vasser,	82
8. Plough,	Samson Felton,	ib.
9. Thrashing and shelling machine,	Edward Thurston,	ib.
10. Ropes, preserving	Amos Salisbury,	ib.
11. Washing ores,	V. Rivafinole, C. Harsleben, and W. Davis,	83
12. Paddle wheel for boats,	H. L. B. Lewis,	ib.
13. Sawing and planing machine,	Thomas Bloomer,	84
14. Planting and digging potatoes machine,	P. Meigs and M. C. Arnold,	158
15. Springs for clocks,	Silas B. Terry,	ib.
16. Gold washing machine,	Daniel Jones,	159
17. Cleaning hides,	Thomas Williams,	ib.
18. Inking apparatus,	Richard Wood,	ib.
19. Cotton press,	Joseph Carson,	ib.
20. Washing machine,	Gideon Lowell,	160

		PAGE
21. Thrashing grain and clover machine,	J. Darrah and J. Kinsey,	160
22. Uniting timber in building, &c.	William Annesley,	ib.
23. Building vessels,	William Annesley,	ib.
25.* Tanning apparatus,	William Brown,	161
26. Power loom,	John Standish,	ib.
27. Temple for the power loom,	John Standish,	ib.
28. Fire engines,	J. J. Giraud,	ib.
29. Stemming tobacco,	Germain Bréant,	162
30. Straw cutter,	Samuel Wilson,	ib.
31. Covering roofs with metal,	Peter N. Ware,	163
32. Bedstead cot,	Peregrine Williamson,	ib.
33. Holding tow lines for boats,	Robert Davis,	ib.
34. Cider mills,	Charles Rice,	164
35. Mangle for cloth,	Thomas Rundle,	ib.
36. Lathe for turning,	Elias Rhodes,	ib.
37. Spinning cotton yarn,	John Thorp,	165
38. Thrashing and hulling machine,	Leuman Cooley,	ib.
39. Plough, combined	Samuel Cline,	ib.
40. Fire proof chest,	John Scott,	166
41. Steam boilers, supplying	John S. Williams,	ib.
42. Mantles, &c. of cast iron,	Henry Libeneau,	ib.
43. Raising mud, &c. from rivers,	Elisha H. Holmes,	167
44. Ornamenting horn and tortoise shell,	M. J. Littleboy,	ib.
45. Kitchen grates,	Levi Disbrow,	ib.
46. Washing clothes, &c.	J. Tenny,	ib.
47. Hulling clover seed, &c.	William Manning,	168
48. Clocks and time pieces,	Jacob D. Custer,	ib.
49. Thrashing machine,	Alonzo S. Smith,	ib.
50. Flax dressing machine,	Joel Dewey, Jr.,	169
51. Hollow glass ware, pressing	John M'Gann,	ib.
52. Cutting channels in soles,	James Cole,	ib.
53. Printing types for music,	George Bruce,	170
54. Fan for rooms,	James Barron,	ib.
55. Thrashing machine,	S. Turner and N. Barnes,	ib.
56. Thrashing machine,	David Flagg, Jr.,	ib.
57. Rotary steam engine,	Caleb Tompkins,	171

December.

1. Grist mill.	J. and D. C. Ambler,	239
2. Window Sashes, making	Charles Thompson,	240
3. Thrashing and Winnowing machine,	Thomas Burrall,	ib.
4. Washing machine,	Alvan Foote,	241
5. Bed key,	J. Blake and D. Cushing,	ib.
6. Steam stove,	Thos. G. Fessenden,	242
7. Sawing veneers,	Caleb. B. Burnap,	ib.
8. Planting corn,	Reuben Coffey,	ib.
9. Moving by animal power,	Joseph C. Gentrey,	243
10. Distilling,	Thomas Gallaher,	ib.
11. Oil from cotton seed,	Gideon Palmer,	ib.
12. Press for oil, cotton, &c.	Gideon Palmer,	244
13. Shoes, farmer's double	Moses Pennock,	ib.
14. Wrought iron nail machine,	G. B. Manley,	245
15. Making spoons,	Archibald Little,	ib.
16. Thrashing machine,	George Jessup,	ib.
17. Water wheel,	James Johnson,	246
18. Machinery for propelling,	T. D. Newson and J. C. Shule,	ib.
19. Circular slide rest,	M. J. Gardner,	ib.

* This and the subsequent numbers are each one too high—56 patents issued this month

		PAGE
20. Sawing timber,	David Stern,	246
21. Paper cutting machine.	John Shugert,	247
22. Curing salted beef,	William A. Tomlinson,	ib.
23. Economical oven,	Abel Stowell,	ib.
24. Churn,	Nathaniel Tiffany,	ib.
25. Trusses for hernia,	James Knight,	248
26. Scale compound lever,	Hosea H. Groover,	ib.
27. Corn shelling machine,	William Hoyt,	ib.
28. Suspenders,	Allyn Baron,	249
29. Steam engine boilers,	John C. Douglass,	ib.
30. Trusses for hernia,	Amos G. Hull,	ib.
31. Trusses for hernia,	Gershom Twitchell,	ib.
32. Washing machine,	Ebenezer Lester,	250
33. Washing machine,	Samuel Bushnell,	ib.
34. Churn,	Samuel Bushnell,	251
35. Grating apples,	David Flagg, Jr.	ib.
36. Boring timber,	Frederick Beckwith,	ib.
37. Propelling spindles,	Russel Phelps,	ib.
38. Saws, jointing and gumming	Henry Johnson,	ib.
39. Wheels for carriages,	J. Eastman and G. C. Rix,	252
40. Cutting screws and turning iron,	J. Eastman and C. Abbot,	ib.
41. Percussion gun locks,	Michael Carleton,	253
42. Washing gold from earth, &c.	Frederick D. Sanno,	ib.
43. Spoons, making from tin, &c.	Robert Butcher,	254
44. Thrashing machine,	Rufus Humpreys,	ib.
45. Making combs,	Julius Pratt,	ib.
46. Steam engine,	Ogden Mallory,	255
47. Cotton roving,	Samuel P. Mason,	256
48. Making bricks,	John C. Porter,	ib.
49. Dressing cloth,	John J. Dudley,	257
January, 1831.		
1. Saving water in mills,	Aaron Foot,	300
2. Tooth extractor, vertical	I. W. Rutherford,	ib.
3. Affixing plates to teeth,	T. R. Vanderslice,	301
4. Steam cooking furnace,	Jesse Read,	ib.
5. Thrashing machine,	Isaac Norton,	ib.
6. Manufacturing ropes,	Townsend and Durfee,	302
7. Stumps of trees, removing	Abijah Gorham,	ib.
8. Stereotype blocks,	G. W. Grater,	ib.
9. Printing types, smoothing	S. Sturdevant,	ib.
10. Casting types,	Mann and Sturdevant,	303
11. Cotton gin frames,	E. A. Lester,	ib.
12. Boats, construction of	Cushman and Loomis,	ib.
13. Grist mill, portable	Henry Weed,	ib.
14. Distilling,	John Cairou,	304
15. Carriages, spring points for	Geo. Stoudinger,	ib.
16. Thrashing machine,	Sam. Turner,	305
17. Thrashing machine,	S. J. Gold,	ib.
18. Tin baker,	Gordin Williston,	ib.
19. Tobacco curing,	T. G. Newbold,	ib.
20. Harrow, revolving	Samuel Rugg,	306
21. Water, applying to wheels,	Wm. Kendall,	ib.
22. Buttons, manufacturing	Charles Goodyear,	307
23. Teaching geography,	Elizabeth Oram,	ib.
24. Plough,	F. M. Waggenet,	308
25. Percussion cannon lock,	Enoch Hiddin,	ib.
26. Double toothed saw,	Stafford Dawley,	ib.
27. Propelling vessels	W. W. Van Loan,	309

			PAGE
28.	Saddles,	Levi Sherman,	310
29.	Water wheel, reaction	John Turner,	ib.
30.	Stiffening hats,	L. L. Macomber,	ib.
31.	Planting seeds, machine for	Smith and Arnold,	311
32.	Applying power to mills, &c.	Dart and Webster,	ib.
33.	Furnace for heating tyre,	Dudley Marvin,	ib.
34.	Propelling machinery,	T. D. Newsom,	312
35.	Tobacco, knife for cutting	J. J. Mapes,	ib.
36.	Conduits for canals,	James Clark,	313
37.	Planing machine,	Jonathan Newhall,	ib.
38.	Churn,	Talmage Ross,	ib.
39.	Saw mill,	Jeremiah Smith,	ib.
40.	Rotary pump,	Thomas Suttor,	314
41.	Tanning,	Osmond Cogswell,	ib.
42.	Dressing staves,	J. G. Conser,	ib.
43.	Cleaning wool,	L. L. Miller,	ib.
44.	Washing machine,	James Hinkley,	315
	February,		
1.	Sausage meat, cutting and stuffing,	Samuel Fahrney,	365
2.	Plough,	John Anthony,	ib.
3.	Potash, manufacturing	Thos H. Sherman,	366
4.	Cooking stove, sheet iron	Emma Steinhour,	ib.
5.	Inclined water wheel,	W. H. Squires and C. C. White,	367
6.	Medicated steam, applying	Boyd Reilly,	ib.
7.	Boxes and hubs for carriages,	Isaac Cooper,	368
8.	Bending tyre, hoops, and bands,	Daniel Shepardson,	ib.
9.	Thrashing machine,	William Emmons,	369
10.	Thrashing machine,	Truman Fox,	ib.
11.	Reaction water wheel,	J. C. Strode,	ib.
12.	Planes for carpenters,	Phinehas Meigs,	ib.
13.	Ovens, double, in chimneys,	R. Bacon and W. E. Marshall,	370
14.	Thrashing machine,	John Harman, Jr.	ib.
15.	Hats, felting and napping,	Thos. J. Cornell,	371
16.	Gas, for illuminating,	Joseph Boston,	ib.
17.	Porcelain teeth, making and setting	Samuel Chamberlain,	ib.
18.	Sickles and files, cutting,	Simon Hornbenk,	372
19.	Mill for grinding corn,	Elisha Bigelow,	ib.
20.	Bats for hat bodies, making,	Stephen Hurlbut,	373
21.	Spinning wool, machine for	David Wooster,	ib.
22.	Thrashing machine,	J. Ketzel and J. Bevier,	ib.
23.	Cheese press, lever	J. C. and E. Pulsifer,	374
24.	Tobacco, stoves, or flues, for drying	D. G. Tuck,	ib.
25.	Plough,	Timothy Miller,	ib.
26.	Overshot bucket wheel,	D. S. Howard,	ib.
27.	Distilling apparatus,	Charles Otis,	ib.
28.	Buttons, manufacturing	Josiah Hayden,	375
29.	Paddle wheels,	Timothy Hunt,	ib.
30.	Steam boiler,	Levi Disbrow,	ib.
31.	Rotary steam engine,	Joel Eastman,	ib.
32.	Water wheel for mills,	Joel Eastman,	376
33.	Pegs for shoes, pointing	W. A. Greenwood,	ib.
34.	Sawing boards,	Reuben Jacobs,	ib.
35.	Moving earth, stones, &c.	Shadrach Davis,	377
36.	Bedsteads,	Rufus Belt,	ib.
37.	Fire engine,	Nathan Pierce,	ib.
38.	Axle Trees for carriages,	Rezin Haslup,	378
39.	Painting, composition for	Chandler Metcalf,	ib.

PAGE
40. Mortise door fastenings, Leonard Foster, 379
41. Printing press, Amos Sherman, ib.
42. Steam engine, Hugh Gordon, 381
43. Pendulum churn, Caleb Angevine, ib.
Aqueducts, &c. buiding, Annesley's—*patent*, 179
Arms, improved fire, Random's—*patent*, 36

B

Babbage's calculating engine, 210
Bache, on safety apparatus for steam boats, 217
Bakewell, on the involute, 99
Bands, or straps, on coupling 137
Bell, Shaw's observations on a patent of Lieut. 93
Bell's percussion cannon lock, reply to Shaw's attack on 292
Beer and ale, keeping, Aitkin's—*patent*, 187
Beef, jerked, curing, Tomlinson's—*patent*, 265
Bent axle and dished wheels, 358
Bits for horses, &c. improved, Surman's—*patent*, 38
Bleaching, treatise on 62, 131
Boilers, Steam Engine, supplying with water, William's—*patent*, 183
———, Douglas's—*patent*, 266
———, remarks on, 268
———, effect of salt water on 289
———, Disbrow's—*patent*, 388
Boring for water, Disbrow's—*patent*, 92
Bricks, preparing clay for, Talcott's—*patent*, 26
Bridges, &c. building, Annesley's—*patent*, 179
Building ships, Annesley's—*patent*, 175

C

Calculating engine, Babbage's, 210
Canals, conduits for, Clarke's—*patent*, 318
Canvas and sail cloth, Ramsay and Orr's—*patent*, 186
——— ropes, &c., manufacturing, Harris',—*patent*, 191
Card, improved fancy, King and Blandill's—*patent*, 84
Car, self-adjusting rail-road, Pollock's—*patent*, 17
———, remarks on, 21
———, rail-way, Howard's—*patent*, 391
Casting reaction water wheels, Wing's—*patent*, 85
Chain, improved gearing, 136
Charcoal, on the making of, 71
Chrome yellow, dying silks a 68
Clay for bricks, preparing, Talcott's—*patent*, 26
Cloth, improved woollen, Hirst's—*patent*, 33
Colic, painter's, 279
Cocks, improved, Rudder and Martineau's—*patent*, 35
Compass needles, remarks on Smith's, 95
Copper ore, smelting, Jones'—*patent*, 33
Corks and bungs, cutting, Bass'—*patent*, 189
Coupling machine, bands, or straps, on 137
Cutting instruments, giving a fine edge to 61

D

Detonating matches, Ure on 105, 202
Distilling, improvement in, Jenks'—*patent*, 321
———, Otis'—*patent*, 388
———, new process of 417
Dying of Silk a chrome yellow, 68

E

Editor's remarks on American patents for October, 1830, 1, 73
——— November, 80,158
——— December, 239

PAGE
Editor's remarks on American patents for January, 1831, 300
———————————— February, 365
Engines, improved steam, D'Arcy's—*patent*, 29
Effects of arts and trades on health, treatise on 412
Epsom Salts, manufacturing, Grisenthwaite's—*patent*, 33
Espy, on hygrometric observations, 221, 361
Explosion in steam engine boilers, Earle, on 154
F
Fancy card, improved, King and Blandill's—*patent*, 84
Farina, &c. from vegetables, Goulson's—*patent*, 30
Feathers, restoring elasticity of 360
Fermented liquors, keeping, Aitkin's—*patent*, 187
Fidding and unfidding masts, De la Garde's—*patent*, 37
Fire arms, improved, Random's—*patent*, 36
Flour, on the souring of American, 102
Fountain pump, Shalder's, 193
France, ordinances of, on steam engines, 272, 323, 399
FRANKLIN INSTITUTE.
Officers and Managers for 1831, 39
Standing committee for 1831, 98
Meeting, quarterly, minutes of twenty-eighth 39
———————— twenty-ninth 294
———, monthly, minutes of 45, 96, 156, 297
———, Board of Managers, minutes of 98
Report, seventh annual 40
———, twenty-ninth quarterly, 295
———, of committee on water as a moving power, 145
G
Gas, manufacturing, Boston's—*patent*, 389
——, generating, Collier and Pinkus'—*patent*, 396
Gay Lussac, on the setting of plaster of Paris, 68
Gearing chain, improved 136
Germination, effects of iodine on 215
Gold and silver, Mexican, process of reducing, 112
Gunpowder and detonating matches, Ure on 105, 202
H
Harrows, revolving, Rugg's—*patent*, 316
Hats, composition for stiffening, Macomber's—*patent*, 317
Health, effects of arts and trades on 412
Herschel's discourse on natural philosophy, 349
High pressure engine, French ordinances on, 272, 323, 399
Hides, scraping, William's—*patent*, 173
Horses, &c. improved bits for, Surman's—*patent*, 38
Hygrometric Observations, Espy on 221, 361
I
Illuminating gas, Boston's—*patent*, 389
—————, generating, Collier and Pinkus'—*patent*, 396
India, first steam communication with 139
Inking apparatus, Wood's—*patent*, 173
Institute, Maryland, 69
—————, report of the, 70
Involute, Bakewell's remarks on the 99
Iodine, effects of, on germination, 215
Iron, manufacturing malleable, Lewis'—*patent*, 27
——, preservation of, from rust, 215
J
Jerked beef, curing, Tomlinson's—*patent*, 265

PAGE

L

Lac, reply to query concerning shell and seed . . . 72
Lancets, &c. giving a fine edge to 61
Lead, resistance of, to pressure, &c. 141
——, Colic from 279
Liverpool and Manchester rail way, travel on . . . 215
Locomotive purposes, applying power to . . . 197, 284

M

Machinery, results of 342, 406
Magnesia, making sulphate of 33
Manganese, ascertaining its value, ... 356
Malleable iron, manufacturing, Lewis'—*patent*, . . . 27
Marine steam engine, Ogden's 121
Maryland Institute, ... 69
——————, report of the 70
Masts, fidding and unfidding, De La Garde's—*patent*, . . 37
Matches, &c. detonating, Ure on . . . 105, 202
Metals, Mexican mode of reducing the precious . . 112
Meteorological observations, . . 144, 216, 288, 360, 420
Molasses, &c. from sugar, expelling, ... 55
Moll, on the invention of telescopes, ... 327
Music, type for, Bruce's—*patent*, ... 185

N

Natural philosophy, Herschel's discourse on . . . 349
Needles, remarks on Smith's compass 95

O

Ogden's marine steam engine, ... 121
Ore, smelting copper, Jones'—*patent*, ... 33

P

Painter's colic, ... 279
Paper, machinery for making, Wilks'—*patent*, . . . 190
——, for hanging rooms, Cobb's—*patent*, ... 31
——, description of various kinds of 123
——, separating knots, &c., Ibotson's—*patent*, . . . 188
Patents, American, specifications of 17, 84, 171, 258, 315, 365, 382
———, English, ... 29, 185, 393
Pine and spruce timber, strength of 229
Piano fortes, improved, Stewart's—*patent*, ... 32
————————, Thompson's—*patent*, . . . 37
Pipes, resistance to water moving in 143
Pivot holes of watches, improvement in 128
Plaster of Paris, on the setting of 68
Plating, Robert's—*patent*, ... 187
Pneumatic process of refining sugar, ... 55
Pollock's remarks on self-adjusting rail-road car—*patent*, . 21
Porter on sugar cane, ... 337
Power, application of, to locomotive purposes, . . . 197, 284
Propelling spindles for spinning, Russel's—*patent*, . . . 269
Pump, Shalder's fountain 193

R

Rail-way, Liverpool and Manchester, travel on . . . 215
———, applying power on 197, 284
———, carriage, Howard's—*patent*, ... 391
———, carriage, remarks on Winan's 47
Rail-road car, &c. self-adjusting, Pollock's—*patent*, . . 17
——————————————, remarks on, . . . 21
Razors, &c., giving a fine edge to 61
———, sharpening by burnishing, ... 364

PAGE
Reaction water wheel, Strode's—*patent*, 382
————————, Wing's—*patent*, 85
————————, improvement in Wing's—*patent*, 86
————————, testimonials in favour of, 89
Reeds, improved weavers, Senneff's—*patent*, 26
Resistance to water moving in pipes, 143
——— of lead to pressure, 141
Results of machinery, 342, 406
Rigging and masting vessels, De La Garde's—*patent*, 37
Ropes and cordage, manufacturing, Harris'—*patent*, 191
Ropes, manufacturing of, Townsend and Durfee's—*patent*, 315
Rust, preservation of iron from 215

S

Sail cloth, Ramsay and Orr's—*patent*, 186
Salt beef, curing, Tomlinson's—*patent*, 265
—— water, effect of, on steam boilers, 289
Sashes, window, Prosser's—*patent*, 185
Saw set, Whiting's—*patent*, 171
Scraping hides, William's—*patent*, 173
Self-adjusting rail-road car, with guide rails, Pollock's—*patent*, 17
Shaft, water wheel, splicing, 292
Sharpening razors by burnishing, 364
Shaw's observations on Lieut. Bell's patent, 93
————————————————— Reply to, 292
Shell lac, &c. reply to query concerning, 72
Ships, building, Annesley's—*patent*, 175
Shoes and boots, improved, Pennock's—*patent*, 264
Signals for ships, Roper's—*patent*, 192
Silk a chrome yellow, dying of, 68
Silver, plating with, Robert's—*patent*, 187
Smelting copper ore, Jones'—*patent*, 33
Smith's compass needles, remarks on, 95
Souring of American flour, 102
Spindles for spinning, propelling, Russel's—*patent*, 269
Spoons, manufacturing, Butcher's—*patent*, 269
Spruce and pine timber, strength of 229
Steam communication with India, first, 139
——— boats, safety apparatus, Bache on 217
——— engines, improved, D'Arcy's—*patent*, 29
——————, Ogden's marine 121
——————, ordinances, French on 272, 323, 399
—————— boilers, Earle on explosions in 154
————————, Douglass'—*patent*, 266
————————, supplying, William's—*patent*, 183
————————, improved, Disbrow's *patent*, 387
————————, effects of salt water on 289
——— and hot water stove, Fessenden's—*patent*, 258
—————————— observations on, by patentee, 261
——————————————, by editor, 263
Stiffening hats, composition for, Macomber's—*patent*, 317
Straight edge of wire, 238
Stringing piano fortes, mode of—*patent*, 32
Sugar cane, culture and manufacture, 337
——, crystallizing, Fawcett and Clark's—*patent*, 191
——, &c. from vegetables, Goulson's—*patent*. 30
——, pneumatic process of refining, 55
——, extracting from cane juice, Derosne's—*patent*, 393
——, evaporating, Shand's—*patent*, 395

	PAGE
Sulphate of magnesia, manufacturing, Grisenthwaite's—*patent*, .	33
Sullivan's remarks on Winan's rail-way carriage, . .	47
T	
Tanning apparatus, Brown's—*patent*, ...	181
———, improvement in, Cogswell's—*patent*, . . .	320
Telescopes, invention of	327
Thrashing and cleaning grain, Lane's—*patent*, ...	270
Timber, uniting, Annesley's—*patent*, ...	179
———, spruce and pine, strength of, . . .	229
Tobacco, drying, or curing, Tuck's—*patent*, . . .	384
Treatise on bleaching, ...	62, 131
Turner on the value of ores of manganese, . . .	356
Types for music, Bruce's—*patent*, ...	185
U	
Ure on gunpowder, detonating matches, &c. . .	105, 202
V	
Vessels, rigging and masting, De La Garde's—*patent*, . .	37
W	
Watches, improved pivot holes for	128
Water, report of Franklin Institute committee on, as a moving power,	145
———, boring for, Disbrow's—*patent*, . . .	92
———, moving in pipes, resistance to, . . .	143
——— wheel, improved, Howard's—*patent*, . . .	386
——— power, new system of . . : :	214
——— wheel shaft, splicing, ...	292
——— wheel, reaction, Wing's—*patent*, : . :	85
———————, improvement in Wing's—*patent*, :	86
———————, testimonials in favour of, . .	89
———————, Strode's—*patent*, ...	382
Weapons of defence, improvements in—*patent* . .	36
Weaver's reeds, improved, Senneff's—*patent* . .	26
Wheels, dished, and bent axle, ...	358
Window sashes, Prosser's—*patent*, . . .	185
Winan's railway carriage, remarks on . . .	47
Woollen cloth, manufacturing, Hirst's—*patent*, . .	33
Wool cards, improved, King and Blandill's—*patent*, . .	84

END OF VOL. VII.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED
BY THOMAS P. JONES, M. D.

MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY, AND OF THE ACADEMY OF
NATURAL SCIENCES, PHILADELPHIA, PROFESSOR OF CHEMISTRY IN THE
MEDICAL DEPARTMENT OF THE COLUMBIAN COLLEGE, AND LATE
PROFESSOR OF MECHANICS IN THE FRANKLIN INSTITUTE,
AND SUPERINTENDENT OF THE PATENT OFFICE AT
WASHINGTON.

VOL. VIII.

NEW SERIES.

PHILADELPHIA:
PUBLISHED BY THE FRANKLIN INSTITUTE, AT THEIR HALL;
THOMPSON & HOMANS, WASHINGTON CITY; G. & C. & H. CARVILL, NEW YORK;
AND MONROE & FRANCIS, BOSTON.

J. HARDING, PRINTER.

1831

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JULY, 1831.

On the Quadrature of the Circle, by the Editor.

Although the practicability of making a perpetual motion is a question settled in the negative by every man well versed in the principles of mechanics; and although those acquainted in the higher geometry, have given up the attempt to square the circle, or, in other words, to find a square the area of which shall be exactly equal to that of a circle whose diameter is given; we are yet not unfrequently amused, through the medium of the journals of the day, with the assurance, that what has eluded the researches of the most able engineers, and the most profound mathematicians, has been *luckily* discovered by some sciolist, without the use of the midnight lamp. In a former number of this journal, we gave some account of the most prominent schemes of perpetual motion, and it is our design in the present article to notice the attempts which have been made to square the circle.

We have been directed to this subject by some recent publications in the papers of Washington city, in which a gentleman in one of the public offices, has triumphantly announced his most complete success in this difficult, if not impossible problem; and informs us that he has entrusted his secret to fifteen individuals, all of whom are perfectly satisfied of the correctness of his principles. We are not told how many out of the fifteen are capable of forming a judgment upon the subject, but we happen, however, to know that at least one of the number is unacquainted with the meaning of decimals; and we also know that those most capable of deciding the question are not, and have no desire to be, of the number of the initiated. A few years ago a similar announcement was made in the Richmond papers; but when the plan was presented to the public, it proved to be one of those gross mechanical modes of approximation, which have been repeatedly proposed. A cube and a sphere were to be made, and their relative masses ascertained hydrostatically. An approximation as inferior to that which the mathematician has obtained, as matter is inferior to mind. Others have proposed to cut a square and a circle out of a plate of metal, or other substance, both equal in thickness, and then to weigh them, ignorant of the fact that neither the weight or dimensions of such articles is capable of being ascertained with a millionth part of the correctness with which the mathematician has squared the circle.

The subjoined account of what has been proposed, and done, upon this subject, is abstracted entirely from MONTUCLA, as contained in his "Recreations in Mathematics," translated by HUTTON.

Montucla divides those who have pursued this inquiry into two classes; the first, geometricians, who, aware of the difficulty or impossibility of the problem, have not been led away by illusions, but have confined themselves to the finding out the most exact methods of approximation. The other class, those who scarcely acquainted with the elements of geometry, and hardly knowing on what principle the problem depends, have twisted and turned the circle in every direction, and have laboured, like the unfortunate Ixion, eternally rolling the heavy burden, without bringing it any nearer to its place of destination. When one error is pointed out to them, they soon return with their propositions in a new, but equally contemptible form; and unhesitatingly contest the best established truths in the elements of geometry, appearing to believe themselves specially appointed by Heaven to reveal truths to mankind, the discovery of which is withheld from the learned, that it may be bestowed upon idiots.

In the time of Aristophanes, the question of the quadrature had already become celebrated, as in order to ridicule Meto, he introduces him on the stage, promising to square the circle.

We first find in the writings of Archimedes, the announcement of the truth, that the circle is equal to the rectangle of half the circumference by the radius. Still something more was necessary, namely, to determine the proportions between the circumference and the diameter; and although he was unable to accomplish this with mathematical precision, he showed that the diameter being 1, the circumference would be more than $3\frac{10}{71}$, and less than $3\frac{10}{70}$, or $3\frac{1}{7}$.

Since that time, if great exactness be not required, in order to find the ratio of the diameter to the circumference, the proportion of 1 to $3\frac{1}{7}$, or of 7 to 22 is employed; that is to say, the diameter is tripled, and $\frac{1}{7}$ of it is added: this seventh is never neglected, but by the most ignorant workmen.

Among the modern geometricians, the first who made any addition to our knowledge on this subject was Peter Metius, of the Netherlands; whose name was mentioned in connexion with the discovery of the telescope in our last number. He ascertained that the proportion between the diameter and the circumference of the circle was very nearly expressed by the terms as 113 to 355; the error being scarcely the ten-millionth part of the circumference.

The celebrated James Gregory of Scotland, undertook, in the year 1668, to demonstrate the absolute impossibility of the quadrature of the circle, and although his conclusions were not universally admitted, they have never been disproved. He gave several very ingenious methods for approaching nearer to the measure of the circle than had been previously done.

The numbers expressing the proportions between the diameter of a circle and its circumference were carried out by M. de Lagny, to 127 figures, or decimals; by which it was shown that if the diameter be represented by unity, followed by 127 ciphers, the 128 figures which he has given as representing the circumference, and which commences with 314, and terminates with 446, will be less than the circumference, whilst it will be greater if the last figure be increased by unity. If we suppose a circle, the diameter of which is *a thousand million times* greater than the distance of the sun from the earth, the error in the circumference would be *a thousand million of times* less than the thickness of a hair.

Euler has pointed out the method by which we may go still further, but there are few who would not pronounce the labour to be superfluous. The supposition, therefore, that there is in England a standing reward of £10,000, or of any other large amount, awaiting the discoverer of the quadrature, must be placed among the prevailing vulgar errors; for with all her liberality, Britain does not give such rewards for the discovery of that which would be of no practical utility whatever.

Among those who have miscarried in their attempts to solve this problem, or who have fallen into ridiculous errors respecting it, the following are noticed by Montucla.

The celebrated Joseph Scaliger, who had no great esteem for geometricians, desirous of showing to them the superiority of a man of letters, in solving, by way of amusement, what had so long puzzled them, attempted the quadrature of the circle, and seriously imagined that he had discovered it. The quantity which he gave was a little less than the inscribed dodecagon. It was therefore an easy task to refute him, which was done by several mathematicians. The only effect produced upon Scaliger was, to throw him into a violent passion, and induce him to pour forth a torrent of indecent abuse upon the geometricians, and to confirm him more than ever in the opinion than they were destitute of common sense.

The celebrated Danish astronomer, Longomontanus, pretended to prove that the diameter of a circle is to the circumference exactly as 100,000 is to 314,185. The famous Hobbes imagined also that he had discovered this long sought secret; and upon being refuted by Dr. Wallis, he published a work with a design to prove that the whole system of geometry was founded upon false reasoning.

A certain M. Liger pretended that he had found out the quadrature of the circle, and commenced by demonstrating that the square root of 24 was the same as that of 25; and of 50 the same as that of 49. This he attempted, not by geometrical reasoning, which he set at nought, but by mechanical contrivances, aided by figures.

M. Clerget made the wonderful discovery that a circle is a polygon with a determinate number of sides, and he thence deduced the magnitude of the point where two unequal spheres touch each other. He demonstrated also the impossibility of the motion of the earth. The affinity of these questions with each other has never been perceived by any other philosopher.

M. Mathulon, a manufacturer of stuffs at Lyons, undertook to act as a geometrician and mechanist, and in support of his pretensions announced that he had discovered the quadrature of the circle, and the perpetual motion. He deposited 1000 crowns to be awarded to any person who should prove that he was in error. M. Nicole effectually did this, and the thousand crowns were awarded to him, and were presented by him to the general hospital at Lyons.

A similar offer of a sum nearly double the amount, was afterwards made by an individual more distinguished for the possession of money than of mathematical learning. His method was to divide a circle into four equal parts by perpendicular diameters, and then to turn these quadrants with their four right angles outwards, so as to form a square, which square he pretended was equal to the circle, although it was manifest that the parts could touch each other in points only, instead of in their whole extent. Three persons appeared as claimants for the reward, so ridiculously offered, but the tribunal at the Chatalet decided that a man's fortune ought not to suffer from the errors of his judgment, when those errors were not prejudicial to society. The author of this offer obtained a sentence from the Academy of Sciences, which was that he should study the elements of geometry; he, however, was still convinced that he had been treated with gross injustice, and that future ages would blush for that in which he lived. Although but few of the pretenders to this discovery cut a figure so completely ridiculous, it is nevertheless true that their propositions have all of them had their foundations in ignorance of geometry.

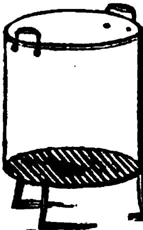
It may be acceptable to those unacquainted with geometry, to learn how a very close approximation may be made to the ratio between the circumference and the radius of a circle, which is in effect the same as discovering the quadrature. If a polygon of any number of sides be inscribed within a circle, and another be circumscribed, both touching it, the two areas thus formed can be ascertained by mensuration, and the exact circumference of each figure may be readily ascertained. Now it is evident that the circumference of the circle must be greater than the one, and less than the other of these polygons. Wellebord Snell, a countryman of Métius, laboured assiduously on this subject; he calculated a series of polygons, up to 5,242,880 sides, so that when it is pretended that a proportion between the diameter and circumference of the circle, his table furnishes the mode of refuting the pretension.

There is an ingenious and simple mechanical mode of proving that the area of the circle is equal to the rectangle of one-half the circumference, by one-half the diameter. Or, in other words, is equal to that of a right angled parallelogram, two of whose sides are equal to one-half the circumference, and the other two to one-half the diameter. Suppose a circle to be taken, and radii to be drawn from its centre to its circumference, numerous, and at equal distances from each other; then let this circle be divided into two parts, each a semicircle; cut through the radial lines from the centre close to the circumference, and open each semicircle out, so that the semi-circumference of each part shall become a straight line, the points of one piece will fit exactly into the spaces of the other, and the rectangle in question will be formed.

On the Application of Anthracite Coal to the Drying of Tobacco. By Erskine Hazard, *Esq. Engineer.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—I noticed in your valuable journal for this month that a patent had been taken out for a plan for curing tobacco. It immediately occurred to me that this object could be very easily effected by placing a grate, with a Lehigh coal* fire in it, in a "tight house" in which the tobacco is hung. The stove or grate to be a moveable article to be placed on the earth floor without any connexion with stove pipe or chimney—the crevices in the roof will furnish a sufficient vent for the gas. This stove or grate is simply a sheet iron cylinder 12 to 14 inches diameter, and of the same length, with a grate at the lower end of it to hold the coal, and open at top, supported by three legs rivetted to it. It should have two eyes or handles rivetted to the top for the purpose of running a small bar of iron through, by which two persons can readily carry it while ignited from one place to another, or two holes punched through the cylinder near the top will answer the same purpose.



In a larger building, two or more of these stoves may be used and will produce any degree of heat that may be desired, and they will not cost more than two or three dollars each.

No danger need be apprehended of the gas arising from the combustion producing any unpleasant flavour in the tobacco—of this, the experience of the brewers who all dry their malt on this principle by permitting the gas to pass through the body of the grain on the kiln, and of many families in this city who constantly bake their bread, cakes, pies, puddings, &c. in the gas, (also on the same principle,) without imparting any peculiar flavour to them, is sufficient evidence.

It is very common at Mauch Chunk, when *seasoned lumber* is required, to pile the green lumber on posts, about eight feet above the ground, and enclose the whole with boards tacked to the pile to confine the heat, and then introduce a grate with coal into the inclosure. The whole pile is thus completely dried in 6 or 8 days, and requires no other attention than to renew the coal in the grate three times in twenty-four hours. The Lehigh coal will be found a very convenient article applied in this way in all the processes where drying is requisite, and particularly in kiln-drying corn. By removing the grates from the building while the ashes are shaken out and the grate replenished with coal, no inconvenience will be experienced from dust.

---

* Anthracite.

As persons who are not accustomed to the use of Lehigh coal, may wish to try this plan, it may be well to state the mode of kindling the fire. Cover the grate with a *thin stratum* of Lehigh coal, then add a quarter of a peck of charcoal—apply your fire, fill up the grate with Lehigh coal, and then *let it alone.* To renew the fire—with a crooked poker clear out the ashes from the bottom of the grate and fill up with fresh coal. The bars of the grate should be an inch and a quarter apart.*

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, May 26, 1831.

Professor ALEXANDER D. BACHE was appointed chairman, *P. T.*

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Matthew Carey, Esq.
- *Marriott's Dictionary, 2 vols. quarto.*
- *Cobbett's Weekly Register,* 1 *vol.*

By Reuben S. Gilbert.
- *The Laws of the Province of Pennsylvania, collected in one volume by order of the Governor and Assembly of the said Province,* 1714.
- *The Cabinet of Natural History and American Rural Sports, first 5 numbers.*

By James Rowland, Jr.
- *Elements of Chemistry, by M. J. A. Chaptal.*
- *Physical and Chemical Essays, translated from the Original Latin of Sir Torben Bergman, by Edmund Cullen, M. D.*
- *A System of Practical surveying.*

By James Mease, M. D.
- *Archives of Useful Knowledge,* 3 *vols.*

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

Recueil Industriel, for November and December, 1830.
Bibliothéque Physico-economique, for January and February, 1831.
Annales de Chimie et de Physique, for October and November, 1830.

---

* The difficulty upon this subject is to bring the coal and the tobacco together; they are the products of different regions, and where tobacco grows wood is plentiful and will be used.—EDITOR.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for October and November.

Programmes des Prix proposés by la Societé d'Encouragement pour l'Industrie Nationale, pour être Décernes, en 1831, 1832, 1833, *et* 1835.

Annales des Mines, No. 3, Vol. 7.

American Annals of Education and Instruction, for May.

Magazine of Useful and Entertaining Knowledge, for April.

Ladies' Book, for May.

Casket, for May.

The Southern Review, for May.

Southern Agriculturist, for January, February, March, April and May.

Museum of Foreign Literature, Science, and Arts, Vols. 14, 15, 16, 17, and Nos. 1, 2, 3, 4, 5, of vol. 18.

The chairman of the Committee on Inventions stated, that the committee had been engaged during the past month in examining several inventions submitted to them, and reports on some of them would be prepared to be submitted to the Institute at their next meeting.

Professor Johnson made some remarks on the subject proposed for discussion this evening, viz. on the best mode of securing the boilers, cylinders, and all other parts of steam engines against loss of heat by radiation and conduction, when it was on motion continued as the subject for the next meeting.

Dr. Hays rose, and after some prefatory remarks, stated in substance as follows. That an attack upon the scientific reputation of Dr. Godman, late Professor of Natural History in the Institute, having been made very recently by a lecturer on Geology, in a public lecture delivered in the hall of the Institute, at which many members of the Society were present; and that a thorough investigation of the subject having resulted in a complete refutation of the attack, he thought it would be interesting to the members of the Institute to be put in possession of the facts upon which the vindication of their late Professor rested.

The lecturer before alluded to, had stated to his class that the animal described by Dr. Godman as new, under the name of *Tetracaulodon Mastodontoideum,* was nothing more than the young of the common mastodon. In support of this, the lecturer had exhibited two lower jaw bones from the collection of the American Philosophical Society, one of which he stated to be that of a young animal, and showed the socket which had once contained the tooth characteristic of the animal described by Dr. Godman, while the other, which he said was that of an adult, was asserted by him to have contained no such socket. The lecturer had also exhibited a tusk which he said was the milk tusk of the young of the gigantic mastodon.

Doctor Hays proceeded to say, that the jaw exhibited by the lecturer as that of a young animal, had proved, on examination, to be that of an adult, as the dentition clearly showed, while in that admitted by the lecturer to be the jaw of an old animal, the remains of the socket which had once contained a tusk was clearly to be seen. And further that the tusk exhibited by the lecturer as a milk tusk, was evidently that of an old animal.

Dr. H. stated that he had communicated to the American Philosophical Society, the proofs of the accuracy of the preceding statement.

A. D. Bache, *Chairman.*

J. Henry Bulkley, *Rec. Sec.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1831.

With Remarks and Exemplifications, by the Editor.

1. For making *Rifles for the sharpening of edge tools;* and a composition for polishing of all kinds of metals; Peleg Barlow, Amenia, Dutchess county, New York, March 1.

A machine is to be used for putting the composition which is employed, upon wooden strips, called rifles; there is to be one composition for grinding, and another for polishing. The machine to be used is particularly explained and distinctly claimed, but there is no drawing of it. The rifles are as follows:—

"For grinding. *Two* parts of white lead, ground in linseed oil, and *three* parts emery. Linseed oil to be added to the mixture in sufficient quantity to make a paste of suitable consistence. Before the paste is spread upon the rifle, a composition of white or red lead and linseed oil, to be applied to the rifle, and dried, before the paste, or cement is spread upon it."

"For polishing. *Two* parts of white lead ground in oil, and *three* parts of red oxide of iron.—To the mixture for polishing, oil in like manner to be added, until the composition becomes of a suitable consistence."

On turning to Vol. 4, p. 175, it will be seen that a patent was obtained by Beriah Swift, living in the same county with Mr. Barlow, for *a rifle for sharpening scythes and other edge tools;* dated June 11th, 1829, which we have thus described.

"Emery, of suitable size, is to be fixed upon properly shaped strips of wood, by means of a mixture of oil, paint, and varnish, which, when dry, forms the substitute for the stones usually employed."

The validity of either claim may admit of some doubt, and it certainly would have puzzled the last patentee, to have distinguished his invention "from all other things before known."

---

2. For *making Axes by Machinery;* being an improvement upon the apparatus called the "oval axe machine;" Stephen Hyde, Williamsburgh, Hampshire county, Massachusetts, March 2.

The original machine was patented on the 29th of January, 1830, and the present application is for an improvement upon the apparatus then claimed. Two dies, different in form from those originally used, constitute the present claim; they consist of an upper and lower die, and are intended for spreading the iron the width of the axe, and forming the lower part of the eye.

---

3. For an *Improvement in Lamps,* by applying the principle of the Argand lamp, to the common wick lamp; Lewis F. Gallup, Woodstock, Windsor county, Vermont, March 3.

(See specification.)

---

4. For a *Stove for burning Anthracite* and other fuel; Stephen C. Roe, New York, March 5. Patent assigned to James P. Allaire, of the same place.

The whole description is comprised in the following words.

"The stove is in the form of a truncated cone, terminating below in a cylinder; the top joined to a hemispherical cup, covered by a lid; or the cone may be without the cup. The pipe is joined near the top."

"What I claim is the conical form of the main body of the stove."

The drawing represents the stove described, both with and without the cup above mentioned. There is no fire-place door, the fuel being put in at top, by removing the lid. The cylindrical part extends no higher than is necessary to form an ash pit, the part containing the fuel being included in the cone.

These stoves are, we believe, made of sheet iron, and lined with fire clay, and usually of very small dimensions, say 18 inches in height, and perhaps 6 or 7 in diameter at the base. They are certainly very simple in their structure, and we are told that the anthracite burns better in them than in stoves of any other form, and have no reason to doubt the correctness of the information.

---

5. For an improvement in *Locomotive Carriages, and Rails adapted thereto;* Emmor Kimber, Kimberton, Chester county, Pennsylvania, March 5.

(See specification.)

---

6. For an improvement in the mode of *raising Vessels out of the Water;* Joshua Cleeves, Elmira, Tioga county, New York, March 5.

It is proposed in this patent to raise a vessel perpendicularly, by means of levers. Wharves are to be built, forming a slip into which the vessel to be raised may enter. A strong frame is to be made, like a raft. This is to fit in between the wharves, and to be the platform upon which the vessel is to be supported. The frame is to be sunk so that the vessel may float in over it, and then be secured upon it in a vertical position, by proper bilgeways, &c. Along each side of the platform vertical pieces of iron rise so as to project above the wharves, where they are to be operated upon by levers, which, it is stated, may be attached, and put into action, in various ways; there are to be poles, or other contrivances, for securing the uprights as the vessel is raised. When the platform has been elevated as high as low water mark, or to the height intended, sliding pieces of timber, ranged in each wharf for the purpose, are to have their ends pass under the edge of the platform to sustain it and the vessel thereon. The whole is described in very general terms, and no claim made. We apprehend that in a practical essay, with a large vessel, the raising with levers would present difficulties which would prove this mode to be very inferior to that of the screw dock, for which it is intended as a substitute.

---

7. For a *Knitting Machine;* John M'Mullin, and Joseph Hollen, Jr., Huntingdon county, Pennsylvania, March 5.

The machine for which this patent is taken manifests an uncommon degree of ingenuity on the part of the inventor. There is a working model of it deposited in the patent office, which we have seen in operation, and although not executed in a workmanlike manner, it operates sufficiently well to remove all doubt respecting the goodness of the work which it may be made to execute. The different parts of the machine are set in motion by the turning of a crank. The loops, or stitches of the article to be knit, hang upon pins, or teeth, which partially surround a horizontal wheel, and project upwards like the teeth of a crown wheel; the stocking is knit by it with the seam open, as in the common stocking frame. When the stitches have extended to a sufficient width, the motion of the crank is reversed, and the wheel is thus moved in an opposite direction.

We had thought of giving the specification, with an engraving of the machine, but shall not do this at present. Although we have spoken highly of the skill of the inventors, we do not believe that the machine will ever come into general use. In rapidity of execution it will fall far behind the stocking loom, and will not probably far exceed that of an expert knitter; besides this, it will be costly in the first instance, will be liable to disarrangement, and require more skill to repair it, than is usually found in country places.

---

8. For a *Thrashing Machine;* Joseph C. Gentry, Kensington, Philadelphia county, Pennsylvania, March 7.

We cannot afford room for the description of this machine, as it resembles so many others. The claim is as follows.

"What I claim as my invention is the twisted reversed screw auger whippers, and the twisted reversed square edged iron bars which form the circle over which the cylinder revolves, and the improvement in the frame or case through which the wind and dust produced by the velocity of the cylinder escapes."

9. For an improved *Block for Stereotype Plates;* Bradbury Hackett, Boston, Massachusetts, March 8.

The general structure of this block is like those commonly used, having fixed lips or catches on one edge, and moveable, or sliding catches on the other. The two sliding catches are forced up against the edge of the plate simultaneously by turning a key which fits on to a pinion. The teeth of this pinion act upon a sliding plate, each end of which forms a wedge, these wedges acting upon the two sliding lips, force them up. There is a spiral spring upon the shanks of the sliding slips, which force them out when relieved by turning the pinion, so as to withdraw the wedges. Some other modes of moving the wedges are described, and considered as included in the general principle.

The claim is "to so much and such parts of the machinery above described, in combination, as is or may be employed by moving the moveable lips to or from the stereotype plates, at one operation, by inclined planes, or wedges and springs, acted upon by a rack and pinion with a key, or in either of the ways mentioned; and the moving of the moveable lips to or from the stereotype plate at one operation."

---

10. For a *Thrashing Machine;* being an improvement in Douglass' Thrashing Machine; Fayette Cross, Sweden, Monroe county, New York, March 8.

As this thrashing machine resembles nearly all those which have preceded it, and is, we suppose, exactly like that of Mr. Douglass, except in the parts claimed, we proceed to furnish these distinguishing characteristics, which are thus set forth.

"The improvement which I claim, is, the introduction of winged gudgeons on the end of the cylinder, which is fastened to the gudgeons by iron wedges; and I also claim the invention of the rakes as represented."

It so happens that "the rakes as represented," are not to be found in the drawing; so that however excellent and original this part may be, we are not enabled to pass upon it the commendations it may merit. Should it prove equal, in point of *invention*, to the application of winged gudeons in the ends of the shaft, we shall be at a loss to find any terms in which we can express our admiration of it.

---

11. For a mode of *Propelling Rail-way Carriages;* Abraham Pawling, city of Philadelphia, March 9.

This patent is taken for a very complex mode of communicating the power applied to a vertical shaft, by a crank, or lever, to the propelling of a rail-way carriage. A wheel, or pulley, is fixed upon a vertical shaft, and from this, endless chains or bands pass round pulleys on the axes of the wheels. There are tightening pulleys to preserve the tension of the band, or chains. The grooves on the wheels upon which the chains run, are furnished with what are called clasps, or springs, which it is apprehended will have a favourable effect on the chain which passes over them. The claim is to the clasps with joints and springs, or screws and bolts, for preventing the chain, or band, from slipping; and the position, combination, and the general arrangements of the parts thereof, for producing the desired result.

---

12. For *Manufacturing Malleable Iron;* Seth Boyden, Newark, Essex county, New Jersey, March 9.

"*Specification.* The improvement consists in mixing rosin, pitch, or tar, with bituminous coal, and applying it as fuel for melting and converting crude or pig iron into malleable castings. The coal is pulverized, or broken in pieces of the size suited to the furnace grate, and mixed with rosin, pitch, or tar, in a proportion as the intense heat is desired, and applied in quantities diminishing in proportion as the rosin is increased."

SETH BOYDEN.

The foregoing contains the whole of the specification; the flame produced will undoubtedly have the effect of keeping off atmospheric air, and in this way protect the metal from oxidation. We do not perceive any other principle upon which it can operate in producing the effect of rendering the iron malleable.

---

13. For an improved mode of *applying Water to Water Wheels;* Joseph Michener, Clinton county, Ohio, March 9.

The wheel used is the common flutter wheel, which is to have eight buckets. The wall of the dam is not to be built vertically, but is to incline two inches towards the wheel. The water is to pass through a funnel, or opening, above the wheel. The arms supporting the buckets are not to form radii with the shaft of the wheel, but are to be set back, to prevent the water falling in towards the shaft. The water is to act upon three buckets at once.

"I claim the setting of the arms back, which prevents the water falling towards the shaft, which will give more power on the wheel; also the inclination of the breast of the dam; and also the fall funnel, and applying the water, or action of three buckets at a time."

Brief as we have been, we have used more words than the patentee in his whole specification, wishing to enable our readers to perceive the whole merit of his invention.

---

14. For an improvement in *Gas Metres;* H. Robinson, Boston, Suffolk county, Massachusetts, March 10.

The object of this improvement is "the introduction of water from the reservoir to the metre at the water line of the metre, by which means the water in the metre is kept at an equal height, though the pressure of the gas in the metre be ever so variable. Also the excluding of the water of the metre and reservoir from the atmosphere, thereby preventing the offensive odour that would otherwise be ed from it.”

unnecessary to describe the particular mode in which this is , as it would not be intelligible without a drawing, and would erest but few of our readers. A patent was obtained on the 11th of June, 1830, by Henry B. Williams, of Baltimore, for a method of effecting the same object, under the erroneous title of an improvement in gasometers.

---

15. For manufacturing *Cast Iron Door Knockers, with Brass Plates;* Increase Wilson, New London, New London county, Connecticut, March 11.

The specification is in the following words.

“The usual mode, heretofore, of manufacturing cast iron door knockers, with brass plates, has been to fasten on the brass plates after the knockers are cast, by means of solder, screws, or rivets. My improvement consists in casting the knockers directly on the brass plates; which may be done by first casting the inside of the brass plates with tin, lead, or other metals which fuse at a lower temperature than brass. The brass plates are then secured in their proper place in the moulds, and the iron poured in, (as is usual in casting iron,) which will readily unite to the brass plates, and secure them on more firmly, and better than is done in the usual way with rivets, &c. INCREASE WILSON.”

---

16. For a machine for *Cutting large Wooden Screws,* for pressing hay, tobacco, cotton, &c.; John Morrison, Hardingsburg, Dearborne county, Indiana, March 12.

This machine is no other than the screw box commonly used for cutting bench screws, and screws of wood generally. The patentee, although he talks of “having invented,” says at the close of his specification, “all I claim as new, and as my invention, is the augmenting and modifying the small screw cutting principle, so as to cut large wooden screws, without injury, and placing it perpendicular so as to apply power sufficient to cut it with one going over.”

We know of nothing more easy than to become an inventor, if making an old and well known instrument somewhat larger than ordinary can give a claim to this title.

---

17. For a machine for *Separating the Knots, Knobs, &c. from the Pulp used in Paper Making,* before the sheet is formed; and also for graduating the quantity of pulp necessary to form the sheet; Solomon Stimpson, Newbury, Orange county, Vermont, March 12.

The machine for clearing the pulp, consists of a tub, which may be 2 feet in diameter; within this is placed a metal cylinder, or curb, which fits close to the bottom of the tub. This may be twenty inches in diameter, and eight inches in width. Around the upper edge of it there are longitudinal openings to admit the pulp to pass through. The pulp is pumped up from the chest, and is admitted through a tube into the inside of the curb. Arms with dashers revolve within this curb, and drive the pulp against the openings where the finer parts pass through, whilst the knots are retained. A spout leading from the space between the curb and the tub, conducts the prepared pulp, to form the sheet. There is a cover to the whole to prevent the pulp from being dashed over.

To regulate the quantity of pulp which shall be supplied, the tube which conducts it into the curb, is in the form of a funnel; the pulp pumped into this keeps it filled, and any surplus runs over, and back again into the chest. A stop cock in the tube, between the funnel and its inner end, regulates the quantity which shall pass in.

---

18. For a *machine to be attached to a common Loom, for Weaving Figured Cloth;* George Deterick, of Lansing, and Jonathan Conger, of Groton, Tompkins county, New York, March 12.

This machine is to be placed in a room above the loom, to which it is connected by means of ropes and treadles; pins are so placed in a cylinder, or board, as to form the intended pattern, and operates in a way very similar to the apparatus well known to weavers; but which would be intelligible to few others even with the assistance of the drawing.

---

19. For a *Machine for Grinding Apples;* Silas Freeman, Jr. New Marlborough, Berkshire county, Massachusetts, March 14.

This machine consists of a hopper to contain the apples, and against the lower part of which revolves a wooden cylinder, surrounded by rows of teeth; the feeding may be adjusted by a screw.

The claim is to "the insertion and forming on the *outermost surface* of the cylinder, rows of teeth in the manner described." At some period or other this mode was undoubtedly new.

---

20. For an apparatus for *Preventing the Bursting, Collapsing, or overheating of Steam Boilers;* William A. Turner, Washington county, North Carolina, March 15.

To prevent the bursting of the boiler, "a large oblong square hole is to be cut in the top of the boiler;" this hole is stopped by a sliding shutter or door of iron, which is confined in a frame of iron surrounding the opening. This door forms a plane inclined to the top of the boiler, and slides in grooves in the manner of a sliding valve. According to the description given, this door is to be opened by levers connecting it with the safety valve, which, therefore, must open previously to the opening of this door.

To prevent the boiler from becoming overheated, there are to be metal rods passing through stuffing boxes in the top of the boiler, these metal rods are to be pressed down by weights, their ends in the boiler are sustained by fusible metal supports, and when these melt, the rod descends, acts upon levers which turn a number of cocks, all admitting water on to the fire.

A valve opening inwards is to admit air as the boiler cools, and thus prevent collapsing.

We cannot follow the description through the long array of levers and other appendages specified and figured, unless we were of opinion that the proposed end was likely to be obtained by these contrivances; willing as we are, we cannot, however, stretch our faith or hopes so far. There is no claim made to any particular part.

---

21. For an *Edging Machine,* or "French horse," *for turning the Edges of Tin, copper, or sheet iron,* for roofing; John Woolley, city of New York, March 16.

The improvements made upon this machine do not stand sufficiently alone in the specification to enable us to distinguish them clearly. One, however, is stated to be the preventing of the closing or flattening of the ends of the bend first formed, by the subsequent bending of the other sides. This is effected by providing grooves in the machine into which these first formed edges pass.

The claims made are rather vague in their character, such as the privilege of varying the machine, and constructing it of different materials. But there is one claim which certainly belongs to another subject, as it makes no part of the edging machine. It is as follows.

"The subscriber claims the privilege of forming metal roofs in such a manner that they effectually resist the driving of rain. This is done by inserting a small piece of metal, (which has been previously bent by his machine,) over each notch in the corners of the sheets; these are to be locked in with them on the roof. These pieces may be secured by nails, and not being exposed to the water, are not so liable to rust. The old practice of driving nails through the sheets is thus dispensed with entirely."

---

22. For an improvement in the *Boiler and Furnace for Steam Engines;* Samuel Forbes, city of New York, March 17.

This consists of a furnace within a vertical boiler. A principal feature of the invention is the causing the bars that form the grate of the furnace to rise in a conical form, which greatly increases the surface by which the fuel is exposed to the action of the air. These bars all meet in the centre of the furnace, rise there above the surface of the fuel, and are surmounted by a cap, perforated with holes, to admit atmospheric air to mingle with the combustible gases extricated from the fuel, and thus to perfect their ignition. The claim is in the following words.

"What I claim as my invention is the particular mode of constructing the fire-place, with the grate rising conically, within a conical cavity. The cap piece for supplying air to the combustible gases. The mode of heating the fuel, and of supplying it to the furnace from the cylindrical chamber; and the general arrangement of the whole for the attainment of the ends proposed."

---

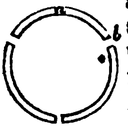
23. For an improvement in the *Grist Mill;* Joseph Yeamans, Ashtabula, Ashtabula county, Ohio, March 18.

This is another portable mill, in which the upper stone is to be the runner, and to be about 18 inches in diameter. The principal, and we believe the only difference between this machine and some others, is the manner in which the stone is held down. This is effected by the form given to the foot of the spindle, which is turned so as to have a neck in it a little above its point, or step. Two plates of metal, forming a collar, embrace this neck, and are screwed on to the bridge tree; there is consequently no loading necessary to the stone, as the bridge tree may be made to draw it down with any desired degree of force. There is no claim made.

---

24. For an improvement in the construction of *Lamps;* John W. Schulze and Joel Trull, Medford, Middlesex county, Massachusetts, March 19.

It is intended by this invention to adapt the argand burner, to lamps of the ordinary construction. The interior as well as the exterior of the flame being supplied with air. The wick is divided into three or more parts, each having its appropriate tube. These tubes, *a*, &c. are segments of an ammulus, or ring, and when placed together assume a form resembling that containing the wick in the argand lamp. An opening is made in each tube for picking up the wicks, as in the common lamp. The air is admitted to the outside of the flame, under the glass burner, it being elevated upon knobs for that purpose; and to the inside of the flame through the spaces, *b*, &c. between the tubes, they not being in contact with each other. The three separate flames are made to unite in one, by a conical ferule, or ring, placed just above the tubes; this inclines the flame inwards; the inner current of air is thrown upon the flame by means of a button. The apparatus is ingeniously contrived, and well described. We are somewhat apprehensive that the interior current may prove insufficient for perfect combustion, but suppose, that on this score, the patentees have satisfied themselves by experiment.



The particular construction of such parts as appear to be new, are claimed, with the mode of combining them with those before known and used.

---

25. For an improvement in the construction of *Trusses for Ruptures;* Jesse C. Earle, Baltimore, Maryland, March 19.

The principal object aimed at in this truss is to adjust the pad with great exactness, so that it may have the desired bearing. The pad is supported on an arm attached to the main spring of the truss. It is fastened to this truss by a screw in its centre, affording the means of removing it from one part of the arm to the other. The arm swivels upon the point by which it is affixed to the main spring, allowing the pad to be turned downwards, or upwards, or to assume any other direction required.

26. For a *machine for manufacturing Boots, or Shoes*, with nails or pegs; Nicholson Millis, city of New York, March 21.

This machine has a frame with two uprights, between which uprights there is a sliding piece, operating as a ram, or driver, to strike upon a moveable piece below it; under this is placed the leather or shoe, to be acted upon. A shaft, turned by a crank, carries wipers which lift the sliding piece, and allow it to fall. The soles are to be cut out by a steel knife bent in the form required for that purpose. The holes are all to be punched at once by means of a circular rim, having points instead of cutting edges. The nails, or pegs, after being placed in the holes, are also all driven home together, the bottom of the last being covered with iron, or other hard metal, to turn or clench their points.

There is no claim made to the machine, but to "the privilege of substituting cog wheels for band wheels; of constructing the machine of wood, iron, or any other suitable metal," &c.

The cutting and punching apparatus have been long used, although not operated upon by a machine exactly like that here described.

27. For an improved *Auger*, called the serpentine screw auger; George Shetter, York, York county, Pennsylvania, March 21.

A patent was obtained by the same gentleman for the *serpentine screw auger*, on the 10th of September, 1829. The thread of this auger is not formed by twisting, but in the manner of those cork screws which have a continued shank, or shaft, or, in fact, like common wood screws. The difference between this and the auger formerly patented, consists in its having a double bit, or cutting edge, the other having had but one. This, it is said, makes it bore more easily and steadily than the original serpentine screw auger.

28. For a *Thrashing Machine;* Abraham W. Summers, Gates, Monroe county, New York, March 21.

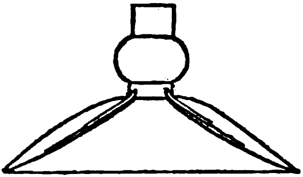
The cylinder of this machine has rows of teeth set along it, from end to end, and between each of these rows there is what the patentee calls a *float*, which is a piece of hoop iron set edgewise, and projecting about five-eighths of an inch from the cylinder. The hollow segment is formed of straight bars, set side by side, and presenting an acute angle to the cylinder. The patentee says—

"The principal features of this improvement are as follows. The placing of the floats between the rows of teeth, which prevent wet wheat or straw forming a wisp round the cylinder. The bars of the concave made diamonting, and the acute angle placed within an eighth of an inch of the teeth, and so close together as to prevent the white caps passing between them. Thereby every kernel is compelled to pass over the whole concave, which clears it from chaff, and smut, and does not cut the kernel."

29. For a *machine for Splitting, Shaving, and Cutting Leather, Skins, &c.;* Augustus S. Dawley, Boston, Massachusetts, March 22.

(See specification.)

30. For an improvement in the *Chandelier, or Hanging Lamps;* William Lawrence, Meriden, New Haven county, Connecticut, March 23.



This hanging lamp has a reservoir, or chamber, in a form somewhat resembling that of the astral lamp now in such general use. This reservoir is composed of two shells soldered at their lower edges, and allowing a space between their upper edges for flat tubes with wicks to pass out. It is proposed, sometimes, to cover the funnel shaped opening at the lower edge with a pane of glass, capable of being removed for cleaning; the glass is represented in the drawing by the straight line at bottom.

"By this improvement much of the light of the lamp will be reflected and concentrated from the inner surface of the globe glasses, and pass diverging by means of the opening through the body of the lamp, and thus prevent the shadow of that, and cause an equal diffusion of light; they are peculiarly adapted to work shops, binacles, &c. and may be made of all sizes."

"I do not claim as my invention, the suspended lamp, the glass globed tubes, and the reflector in common use; nor the opening simply through the body of the lamp. But I do claim as my invention the means of making them altogether more useful than heretofore, viz. by the bell shaped opening of the well; the tubes for the wicks; the feeders; the bottom glass; and the mode of construction and suspension, as above described, and thereby its adaptation to produce the results specified above."

31. For a mode of constructing *Wheel Carriages,* called "the rolling lever carriage;" Henry Chapman, Corinth, Saratoga county, New York, March 24.

For one, but not a first, account of this *invention,* we refer our readers to Vol. 4, p. 259, where it will be seen that a patent for an improvement in the application of wheels to carriages, issued to George Bridgman of Connecticut, on the 16th of July, 1829. As these improvements, so called, are identical, we shall not repeat what we then said. The plan is to sustain the load upon a carriage with small wheels, and to allow the rims of those wheels to rest upon the insides of the rims of large wheels.

---

32. For a *new Alloy, or Compound Metal, applicable to the Sheathing of Ships,* and other useful purposes; John Revere, M. D. a citizen of the United States, but now residing in England, March 24.

(See specification.)

---

33. For an improvement in the construction of *Steam Boats, for the passage of rapids;* Thomas Blanchard, Machinist, Springfield, Hampden county, Massachusetts, March 28.

A boat to ascend rapids it is observed, should be wide at the bows, flat in the bottom, and rising gently, say about an inch in the foot, so that the current striking under it may tend to raise the bow and pass directly under the boat, not passing, as in keel boats, towards the sides. The stern should rise from the bottom at a greater angle than the bow.

"The construction of the boat designed by this applicant is adapted by its lightness and strength for the passage of rapids, the requisite strength being gained by skilful combinations of carpentry, consisting essentially in the support of the floor, the bow, and stern, by an arch extending from the extremity of the bow to the extremity of the stern. This arch may be constructed in many different modes of carpentry."

A mode of constructing this bracing arch is described at considerable length, and we are informed that "there are other modes of constructing the arch familiar to men skilled in the art and means of carpentry."

The boat is to be propelled by a paddle wheel, by means of a steam engine, with a horizontal cylinder.

"The principle of this improvement consists in the combination of a steam engine of adequate power, and convenient structure, with a flat bottom boat, having the bottom, bow, and stern, with the water wheel placed therein, as aforesaid, sustained and stiffened by an arch, substantially, as aforesaid, or by arches as hereinafter described."

There appears in the description of the distinguishing feature of this boat, a want of explicitness; the invention is not sufficiently tangible, and the patentee appears to be aware of this. He observes that "there have been heretofore flat bottom boats, and it may be that steam engines have been placed in them, with water wheels in the stern; but this applicant avers that no boat having a bow, bottom, and stern, of the construction aforesaid, and a water wheel placed as aforesaid, sustained and stiffened by an arch, or arches, of carpentry, had ever been invented, or known, and used, before this applicant invented his combination. This applicant having constructed said combination, and put it in successful operation in the Allegheny river."

---

34. For an improvement in the *mode of Mixing Paint;* Jonathan Linnell, Jr., Orleans, Barnstable county, Massachusetts, March 26.

(See specification.)

---

35. For a *Machine for Pressing Bricks;* Archibald M'Clung, Fairfield, Rockbridge county, Virginia, March 26.

A firm bench is prepared, upon which lies a stout piece of timber capable of sliding backward and forward, horizontally, on the bench. Each end of this piece of wood is faced with iron, and forms a follower, or piston, by which the pressure is to be effected. The piston is moved towards either end by means of a lever, which, when the piston is in the middle of the bench, stands vertically; its upper part forms a handle, and upon its lower end there are teeth which take into teeth forming a rack upon the piston. There is an iron mould at each end of the bench, to receive a brick, and when the lever is drawn down to press a brick, at one end, it touches a rod, which, operating upon another lever, raises a pressed brick from the mould at the opposite end.

The claim is to "the machine for pressing bricks as before described."

---

36. For an improvement in the *Loom for Weaving Webbing, Bed Binding, Tape, &c.;* Asa G. Bill and George Spalding, Middletown, Middlesex county, Connecticut, March 28.

Without the whole specification and drawing we cannot attempt an explanation of the improvements proposed, nor will the claims throw much light upon the subject. Those interested, therefore, must have recourse to the patent office for full information. The claims are to "the taking up of the goods as wove, by calender rollers.—The slanted or mortised lever for regulating the motion of the calender rollers.—The springing of the harness by rods.—The holding of the shuttle after it passes through the warp."

---

37. For an improved mode of *Instituting and Drawing Lotteries;* James Kenny Casey, Baltimore, Maryland, March 28.

(See specification.)

---

38. For an improved *Machine for Pressing Bricks;* John Sites, Harrisonburg, Rockingham county, Virginia, March 29.

In this machine the brick, contained in a suitable mould, is operated upon simultaneously by two pistons, one above and the other below the mould. A system of levers is so arranged that one of them shall act upon the upper, the other on the lower piston. The particular arrangement adapted is not a subject for mere verbal description; the whole machine is claimed, the terms used being the same as those in No. 35.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in Lamps, by applying, in a new way, the principle of the Argand Lamp, to the common Wick lamp. Granted to LEWIS T. GALLUP, *Woodstock, Windsor county, Vermont, March* 3, 1831.

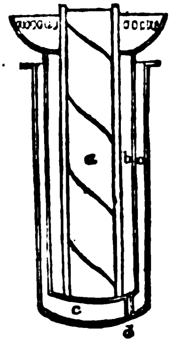
THE essential character of the invention consists in adapting the argand burner to lamps with imperforate bottoms.

To effect this, a cylindrical tube is constructed concentric with, and interior to, the wick, destined to convey the current of air through its centre, and this tube is furnished with a spiral groove upon its exterior surface, for the purpose of raising or depressing the wick, by a revolution of the tube which contains it, in precisely the same manner as the common argand lamp. The air tube, however, instead of terminating in an orifice at the bottom of the lamp, receives its current of air through a channel which opens beside the wick, at the top of the lamp.

The channel is furnished in either of the following methods. In the first the interior, or air tube, is to be enclosed in a second, which is concentric with it, and so much larger, that the intermediate space is sufficient for the reception of the wick and the moveable tube which contains it. This tube, as it is enclosed by a third, or exterior tube, may, for the convenience of description, be called the middle tube. The exterior tube is so much larger than the middle one, that the space between them is equal to, or greater than the capacity of the interior tube, so that the descending current of air, which passes through this space, furnishes a supply to the interior tube through which it ascends, as in the common argand lamp. The exterior tube is closed at the bottom, but descends far enough below the other to leave room for the current of air which passes around under the space between the middle and interior tube, and this space, which, as before remarked, contains the wick, is closed at the bottom by a circular zone, so as to prevent all communication between the air passage and the oil that supplies the wick. To supply the wick with oil, one or more tubes pass across the air passage, opening upon the inside of the middle, and outside of the exterior tube, to which tubes they are fastened by solder.

According to the second plan proposed for admitting the atmosphere to the bottom, the air tube itself is constructed just as before, except that it is closed at the bottom. The descending current of air is thus furnished by one or more tubes, which pass down by the side of the wick from the top of the lamp, and enter the bottom of the tube, to which they are joined by solder.

Gallup's Improved Lamp.



In both these cases, the ascending current of air which supplies the exterior of the flame, passes through a circular row of perforations in the flanch which supports the chimney of the lamp as in the common argand burner, and an air hole made through the lamp, or cylinder flanch, to let the air into the oil which surrounds the outer cylinder, or on the common argand principle.

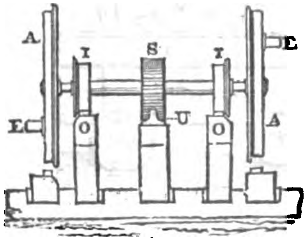
LEWIS F. GALLUP.

a, spiral tube interior to the wick.
b, space for the wick.
c, space for air to pass to the interior tube.
d, pipe for admitting air to the wick.

Specification of a patent for Locomotive Carriages, and Rail-roads adapted thereto. Granted to EMMOR KIMBER, *Kimberton, Chester county, Pennsylvania, March* 5, 1831.

THE invention consists principally in employing the power of locomotive engines on acclivities, in such manner, that by diminishing the velocity of its carriage, the effective force of the engine will be increased in the same ratio—thereby superseding the necessity of stationary engines.

Fig. 1.



A, A, Fig. 1st and 2nd, are the common wheels of a locomotive carriage, (3 feet in diameter,) to which the power of the engine is applied, by a wrist or crank at E, E. On these wheels the locomotive carriage runs upon a plane, drawing the train forward on the rails, nearly nine feet for every evolution. I, I, are two smaller wheels, (attached to A, A, or separate,) 1 foot in diameter, and placed upon the same axle with A, A. To ascend acclivities the locomotive carriage runs upon I, I, upon their own rails, O, O, raising the common wheels clear from their rails,—and therefore the carriage with the train moves forward only *three* feet for every revolution.

The diameter of the wheels, being as three to one, the engine employs three times as much power in a given space on the smaller wheels, as on the common ones—but the carriage and train move forward on the rails proportionably slower, and so of wheels of any other proportions, as four to one, five to one, &c.

On the middle of the fore axle is placed a cog wheel, S, of like diameter with the smaller wheels, to work free in the cog rail, U, to prevent slipping on great ascents. This use of the cog wheel is known and has been variously proposed and tried. The improvement consists in substituting one cog wheel and its rail in the centre, in the stead of mixed rails, and cog wheels on both sides of locomotive carriages.

W, on Fig. 2, is a drag, or pall, that may be attached to locomotive carriages, and every car in their train to work upon the cog rail, U. Its use is well known to prevent a slip or slide in cases of accidents on great acclivities, but it derives new importance from its connexion with the cog rail, U, elevated in the middle of the road.

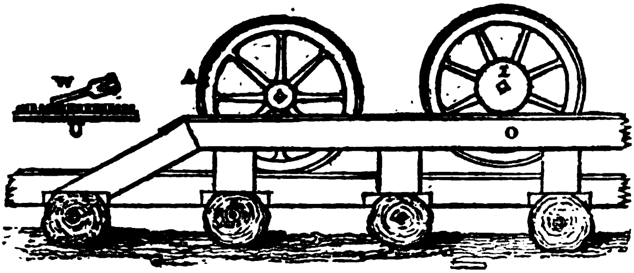
The ascending rails, O, O, and U, may be so constructed, as to rest upon the foundations with the common rails, and be raised to their proper height by blocks: they are only used in ascending acclivities, and for the small wheels. The hind wheels of the locomotive carriage, and the wheels of all the cars in the train, run on the common rails.

In this specification the wheels on the fore axle only are mentioned, because the power is considered as applied to the fore wheels. If the power should be applied to the hind wheels instead, or in part on both fore and hind, the principle would not thereby be changed. The small additional wheels on either, or on both, would be the application of power described and claimed as my invention.

Emmor Kimber.

Side View of Kimber's Rail-way and Carriage.

Fig. 2.



Abstract of the specification of a patent for a Machine for Splitting, Shaving, and Cutting Leather, Skins, and other substances. Granted to Augustus S. Dawley, *Boston, Massachusetts, March 22,* 1831.

This improvement rests upon a combination of machinery in a manner new and hitherto unused, to effect with ease, precision, and rapidity, the shaving, splitting, or cutting of leather, skins, and other substances, in any desired thickness, breadth, and length. Every piece of the machinery used in this invention may have been used before separately, and for other purposes, and the combination only is here claimed.

Fig. 1.

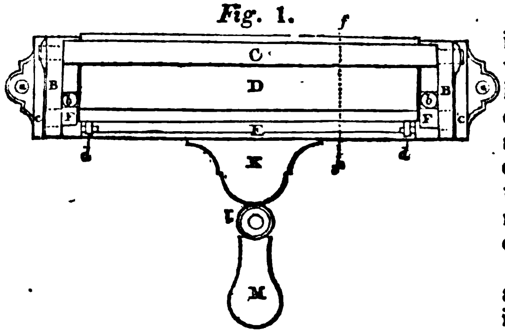
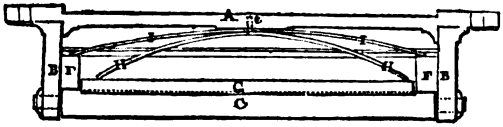


Fig. 1, in the drawing, is a perpendicular view of the machine in its place, as fitted for operation. Fig. 2, is a view of the back side of it. Fig. 3, is a section cut from front to rear at the place marked *f*, *f*, Fig. 1.

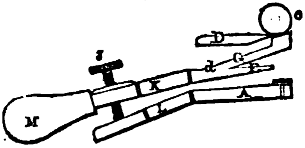
A, Figs. 2 and 3, is a bed-plate, of cast iron, increased in thickness towards its centre, to double the thickness of the other parts, in order to give it the strength necessary for the bearing of the screw by which the moving plate is moved on its pivots. At each end of the bed-plate is a screw hole, *a*, *a*, Fig. 1, to fasten the machine to a block or table.

Fig. 2.



B, B, Figs. 1 and 2, are upright shoulders, on plates running across to sustain the machinery. C, Figs. 1, 2, and 3, is a polished wrought iron roller, turning freely on its axis, and supported by B, B. This serves as a gauge to regulate the thickness to which the leather or skin is intended to be cut. Its bearings may be so regulated that the roller may be brought nearer to, or removed farther from the edge of the knife at pleasure.

Fig. 3.



D, Figs. 1 and 3, is the knife, or cutting plate, fastened by nuts *b*, *b*, its edge resting nearly under the centre of the roller C.

E. Figs. 1 and 3, is the moveable plate, made as strong as the bed-plate. F, F, Figs. 1 and 2, are two shoulders, or upright plates on E, and of the same thickness and width; they lie within the upright plates on the bed-plate, and are fastened to them by the pivots *c*, *c*, Fig. 1. The shoulders of the moving plate move on their pivots to the extent required to vary the position of the edge of the knife. The motion of the moving plate and knife are effected by means of the screw J, and the spring I.

C, on Figs. 2 and 3, represents the shaving plate; its use is to guide the water part of the skin which is cut off, obliquely down from the edge of the knife. The front of the shaving plate, where it rests on the moveable plate, is secured to the shoulders on the moving plate by pivots, *d*, *d*, Fig. 1, on which pivots it turns freely. Its junction is shown also at *d*, Fig. 3. The back part of the shaving plate is nearly a square bar, and is supported by the spring, H, as seen in

Fig. 2. The leather to be cut enters between this bar and the roller, as seen Fig. 3. The springs H and I, are fastened to the bed-plate by a rivet, shown at *e*, Fig. 2. The spring H must have sufficient strength to sustain the C against the skin to be cut, so as to keep it against the roller.

The knife is graduated by means of the spring I, and the screw J. That screw passes through a hole tapped in the lip K, Figs. 1 and 3.

The lips, K and L, which are projections from the bed-plate and moveable plate, are depressed, or sloped downward, for the purpose of permitting the strip of leather, and shaving, to pass freely over the screw.

M, is a wooden handle at the end of the lip on the moveable plate, for convenience in handling the machine.

The leather introduced between C and G may be drawn through in any convenient mode.

It will be observed by inspecting the machine, that the knife plate is so fastened that it is impossible for it to slip back; and as the edge of the knife wears away, the screws or nuts are readily so adjusted that the edge may be brought into the desired position by sliding the plate towards the collar, and the arrangement for thus easily changing the position of the edge of the knife, is also an advantage over the former mode of fixing the knife in shaving or cutting machines.

Specification of a patent for an improvement in the mode of mixing Paint. Granted to JONATHAN LINNELL, Jr., *Orleans, Barnstable county, Massachusetts, March* 26, 1831.

TAKE one pound of unslacked stone lime, and add to it seven pints of warm water put these into an air tight vessel, and let them stand about two hours, or until the lime be well slacked, then separate the liquid from the sediment and put it into another air tight vessel. Take two ounces of sugar of lead and dissolve it in a pint of pure fresh water, and add this to the lime water. Then add linseed oil in quantity equal to two-thirds of the above mixture, and stir the whole well together till it forms a complete body, before mixing it with the paint.

The above composition is for *inside* painting.

For *outside* painting, take one pound of unslacked stone lime and put it into four quarts of warm water, and slack it as before. Dissolve two ounces of sugar of lead in a pint of clear fresh water, as before, and add to it the lime water; to this add linseed oil in quantity equal to the whole of the last mentioned mixture, and stir them till they form a complete body, and then mix them with the paint.

Amongst the advantages which this paint, mixed as above, possesses over common paint, is, that it requires no driers of any kind, and for a given quantity of work, less oil is required.

What I claim as my invention, and which I wish to secure by letters patent, is the mode of mixing paint as above described.

Jonathan Linnell, Jr.

Remarks by the Editor.—This patent is essentially the same with that of Mr. Metcalf, noticed at page 378 of the last volume. In that, soap and water were used, in this, lime and water, the effect of the lime being to convert a portion of the oil into soap. The remarks formerly made apply with equal force to the present patent, namely, that the effect will be to render the paint less durable, the binding property residing in the oil exclusively.

Specification of a patent for an improvement in the mode of Instituting and Drawing Lotteries, and of renewing and perpetuating them at pleasure. Granted to James K. Casey, *formerly of New York, but now residing near Baltimore, in Maryland, March* 28, 1831.

To all to whom these presents shall come:—be it known, that I, James Kenny Casey, Gentleman, have invented a new and useful improvement, being a mode of instituting and drawing lotteries, as well as renewing and perpetuating them at pleasure, without those excitements and appeals which are now so constantly resorted to, and which are alike injurious to the public morals and to the condition of the poorer classes of society, who should be assiduously excluded from all modes of enterprise inconsistent with their means and their duties.

This method of forming, drawing, and renewing lotteries, consists of any given number of tickets, or debentures, issued under the authority of any state government, for the benefit of the state, or of the general government of the United States, for the benefit of the nation, or otherwise, not inconsistent with the laws of a state, or of the United States.

And of this number of tickets, or debentures, a certain declared number shall be fairly drawn out of the whole mass, which shall each be entitled to the amount, or prize, which may be previously affixed to the order in which it is drawn: and this sum shall, without any delay or deduction whatever, be paid to the holder, less the amount of one ticket in the ensuing lottery with which the holder of the prize shall be furnished. Thus, if the ticket, from its number and the order in which it is drawn, be entitled to $100,000, the fortunate holder, (provided tickets cost $50 each,) shall instantly receive in cash $99,950, and one ticket in the then immediately ensuing lottery; and if his number only draws a $50 prize, he will only receive another ticket for the following lottery: and if his ticket be amongst the undrawn numbers, it will only be entitled to one-half, or thereabouts, of the original cost of a ticket; which proportion is only available towards the purchase of a ticket in the then ensuing lottery, by which means the drawing of one lottery always effects the sale of another, as each ticket and each share of a ticket act separately, and are not entitled, by combination, to enter on a purchase in a new lottery; for instance, two undrawn halves cannot purchase one half, but each must act for itself, and the holder make up the balance in cash and buy two halves. Thus about half a million of dollars for the common security and the benefit of the state, or the nation, would always be in hand.

I shall now, for the purpose of making my improvement, and the principle upon which it is founded, and upon which it acts, more clearly understood, detail the particulars of the plan as it would exhibit itself upon a scale of 20,000 tickets, or numbers, each ticket at 50 dollars, and no share less than a quarter, which, of course, would cost $\$12\frac{50}{100}$. And here it may be necessary to remark, as the lottery, from its own nature, would spin itself out into endless duration, that if any ticket, or shareholder, were desirous of selling, either before drawing, or during the intervals of drawing, the market price would always be obtainable; and, from the clear, and decided superiority of the plan, there can be little or no doubt that the price of tickets and shares must always carry a very handsome premium.

20,000 tickets, or debentures, at $50,			$1,000,000
Off a small per centage—say 5,			50,000
For immediate distribution,			$950,000
1 prize of	$125,000	$125,000	
1 do.	100,000	100,000	
1 do.	50,000	50,000	
1 do.	40,000	40,000	
1 do.	12,050	12,050	
2 do.	12,000	24,000	
5 do.	10,000	50,000	
10 do.	1,000	10,000	
20 do.	500	10,000	
100 do.	100	10,000	
500 do.	50	25,000	
642 drawn			
19,358 undrawn	25	493,950	
			950,000

Of the drawn numbers, consisting of 642 tickets, the prizes may be assigned, in any amount, or in any order in which they may come from the wheel; for instance,

Amount for distribution without deduction or delay,				$950,000
1st drawn		$50,000	$50,000	
10 next,	(2nd, &c.)	1,000	10,000	
1 do.	(12th,)	12,050	12,050	
20 do.	(13th, &c.)	500	10,000	
1 do.	(33d,)	125,000	125,000	
250 do.	(34th, &c.)	50	12,500	
1 do.	(284th,)	40,000	40,000	

100	do.	(285th, &c.)	100		$10,000	
5	do.	(285th, &c.)	10,000	-	50,000	
100	do.	(390th, &c.)	50	-	5,000	
1	do.	(490th,)	12,000	-	12,000	
100	do.	(491st, &c.)	50	-	5,000	
1	do.	(591st,)	12,000	-	12,000	
50	do.	(592nd, &c.)	50	-	2,500	
1	do.	(642nd,)	100,000	-	100,000	
642	drawn,					
19,358	undrawn,	$25 -		-	493,950	
						950,000
20,000						

The great advantage, and, indeed, what I shall call the chief glory of this plan is, that it must inflict a death blow upon all those schemes of morbid excitement, and of complicated fraud and treachery which have hitherto acted, without one moment's intermission, upon those who, from the poverty of their circumstances, and the desperation of their hopes, and calculations, are undoubtedly the least protected parts of society.

And should the public convenience, or interest, require a change of the scale, or amount, involved in the drawing, or in any way make it adviseable at any time to work out the old lottery, the same may be done at the termination of any drawing, by paying off in cash, both the drawn and undrawn numbers once every third year, or less, or more frequently, as it may seem just, or desirable. And, to avoid any loss from stolen, mislaid, or destroyed tickets, or shares, it is desirable that each purchaser of one or more tickets, or shares, should assign to the number, or numbers, thereof, a name as well as location, (real or imaginary,) to be registered, and mentioned, when payment is required.

In testimony that the foregoing is a true description of my improvement in forming, drawing, and continuing, or terminating and renewing lotteries, upon principles alike fair and intelligible, and with the hope of attracting those who now waste their time, money, and morals, at Faro-tables, or other places of unlicensed, improper, and unfair adventure, and to give to speculations of this kind, all the equality and justice of which from their nature they are susceptible, I have hereto set my hand at Baltimore, in the county of Baltimore, and state of Maryland, this first day of February, eighteen hundred and thirty. James Kenny Casey.

Specification of a patent for a new Alloy, or Compound Metal, applicable to the Sheathing of Ships, and other useful purposes. Granted to John Revere, *M. D. a citizen of the United States, but now residing in England, March* 24, 1801.

My invention, or discovery, of a new alloy or compound metal, consists of zinc and copper combined in the following proportions, viz. Zinc, ninety-five parts—copper, five parts, by weight. To form a complete union of these two metals in the above proportions, so that an alloy suited to the above named useful purposes may be formed, I find the following a convenient method. Having weighed out the above named metals, in the above named proportions, I proceed to melt them in separate vessels. As soon as the copper is melted, I add to it a part of the zinc. The precise quantity is not important, but I add as much zinc as the crucible will, conveniently, contain. I prefer to add the zinc to the melted copper, while it, (the zinc,) is in a solid state. By agitation, or stirring, and exposing them to a suitable temperature, I thus cause the copper, and a portion of the zinc completely to combine. A portion of the zinc being thus combined with the copper, as soon as the remainder of the zinc, contained in a different vessel, is melted, I add it to the zinc and copper, and by stirring cause as complete a union as possible of the zinc and copper, in the above named proportions. To prevent the combustion of the zinc, which is apt to occur when exposed to the temperature of melted copper, I, from time to time, throw into the vessel containing the melted copper and zinc, some flux, as charcoal pulverized, or common salt. As my object in doing this is to exclude the air and thus prevent the combustion of the zinc, I add a sufficient quantity to cover the surface of the metals. The alloy thus formed may then be cast into ingots to be rolled into sheets, formed into nails, or cast into any other shape according to the useful purpose for which it is designed. The above I find a convenient method of combining those metals, but any other may be employed which will effect as complete and equal a union as possible of these two metals, in the above named proportions. But it is not necessary that the metals should be exactly in the above named proportions, for any other proportions, not exceeding on the one hand, ninety-one parts, by weight, of zinc, to nine parts of copper; or, on the other, ninety-eight parts of zinc to two of copper, will produce a useful effect. But about ninety-five parts of zinc to five of copper, will be found the most convenient in practice. For it is to be observed that as the proportion of copper to zinc exceeds five *per centum*, the alloy becomes more brittle and more difficult to work; and as it falls short of five *per centum*, the power of the alloy to resist corrosion is proportionably diminished.

Finally, I claim in the above specification to have discovered that when zinc has, as above described, a small portion of copper combined with it, its liability to corrode is essentially diminished, and that the compound metal thus formed may be advantageously employed for the sheathing of ships, and various other useful purposes.

John Revere.

ENGLISH PATENTS.

Patent granted to Joseph Harrison, *of Wortley Hall, in the parish of Tankersley, in the County of York, Gardener, and* Richard Gill Curtis, *of the same place, Glazier, for certain improvements in glazing Horticultural and other buildings.—Dated* 6*th October*, 1830.

The object of this patent is stated to be the giving a nearly even or plane surface on the upper side of the glass coverings of hot-houses, and other similar buildings.

The frame is furnished with a suitable number of bars, and they are both rebated on the under side for the admission of the panes of glass. A thin coat of white lead or putty is placed along the grooves, and the glass is fitted in, so that their edges overlap each other a little alternately at each end. A screw, (the head of which is supplied with a soft metal washer,) is inserted in the bars at the corner of the panes, and forms their support at this point, a piece of the glass being crumbled off to allow of the passage of the screw. Several small wedges are then driven into the framing, which are allowed to project a short distance, and complete the support of the glass.

Patent granted to Henry Calvert, *of the City of Lincoln, Gentleman, for an improvement in the mode of making Saddles, so as to avoid the danger and inconvenience occasioned by their slipping forward.—Dated* 26*th October*, 1830.

This improvement consists in attaching a spring or elastic plate to each saddle-tree point, which is effected in making up the saddle, and before it is what is technically called drawn on. The spring or plate is caused to project forward in a curved line from the tree-point, and bends slightly under the belly of the horse. The forward girth is buckled to the springs, and nearly touches the fore leg of the horse, and prevents the saddle from getting on the withers of the animal.

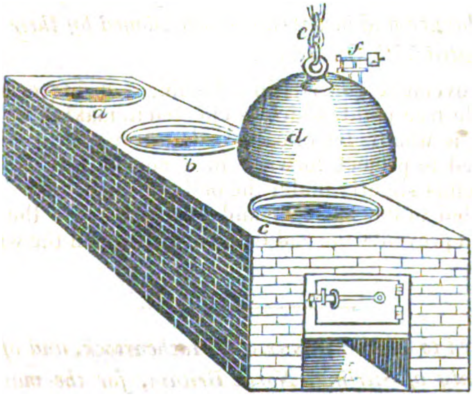
Patent granted to John M'Innes, *of Auchenreock, and of Woodburn, in the county of Stirling, North Britain, for the manufacture or preparation of certain substances, which he denominates British Tapioca, and the Cakes and the flour to be made from the same.—Dated* 24*th April*, 1830.

The patentee states his invention to be a manufacture or preparation of "bulberous-rooted" plants, indigenous to Great Britain, but more particularly the potatoe, from the strength of its mucilage, and its easy accessibility.

The roots, whether potatoes, parsnips, or beet-roots, are to be well cleansed and washed; they are then grated or mashed in the same way as in making potatoe starch, and the mucilage is passed through common sieves to separate it from the fibres; it is then exposed to the air to evaporate, and subsequently in a cast iron pan, which latter is placed on a fire to dry the contents thoroughly: these are constantly stirred to prevent their burning or sticking to the pan. When sufficiently dried it is ready to be ground, and is then suitable for the purposes to which flour is usually applied. It is observed by the patentee, that this is the same process he pursued for several years in the West Indies in the manufacture of Tapioca from the Cassada root, and that it will be found a very nutricious aliment either in conjunction with wheaten flour or separately.

To A. G. GARNETT, *of Demarara, Esq. a patent "for certain improvements in manufacturing Sugar," was granted on the 24th of July,* 1830, *and the specification was enrolled in the Enrolment Office on the 24th of January,* 1831.

THE principal improvement in Mr. Garnett's process, consists in the application of a dome-shaped iron cover, for the teach or concentrating pan suspended over it in such a manner as to be capable of almost instant application and removal, by which the process of supplying and removing the materials is greatly accelerated.



A perspective representation of this apparatus is here given: *a*, *b*, shows a series of clarifying pans, which are to be employed merely in the usual manner; and *c* represents a teach or concentrating pan with a dome-shaped cover, *d*, of cast iron, weighing about seven hundred pounds. This cover is suspended over the teach by a chain, *e*, which passes over a pulley and round a drum, or barrel, with a handle for raising and lowering the cover: *f* is a safety valve, through which the aqueous portion of the sirop escapes in the form of steam through the safety valve. The cane juice having been clarified in the usual manner, is conveyed into the teach, and the cover applied; when the boiling, or evaporation of the aqueous particles will immediately commence and proceed with great rapidity: so that in the space of five minutes an additional quantity of sirop may be introduced, and in a few minutes more, a second supply will be required; and this continued for half an hour, when the teach will require to be employed and the operation recommenced. Therefore, the sugar in the teach may be changed every half hour: and as no time will be wasted in fitting the cover on the teach, much more work will be effected with the same labour and fuel. When the operation is completed the sugar is to be put into vessels of about six feet long, four feet wide, and two feet deep.

To M. Robinson, *of Great George Street, Westminster, a patent for "certain improvements in the process of making and purifying sugars," was granted on the 5th of August,* 1830, *and the specification was enrolled in the Enrolment Office on the 5th of February,* 1831.

This patentee applies his improvements to the purifying of the cane juice which is to be extracted in the usual way. He applies to the juice a saturated mixture of alum and lime, in the proportion of two pounds of the mixture to a hundred gallons of the juice. These being intimately mixed, the acid is to be neutralized by the application of milk of lime, in the proportion of three pounds to a hundred gallons. If there be an excess of acid it will be discovered by the application of the test paper usually employed by chemists to detect acids, and more milk of lime must be added; and if there be an excess of alkali, it may be discovered by the application of the test paper used for detecting alkalies, and more juice must be added. When the mixture ceases to effect either the test for acid or alkali, the impurities will be precipitated, and may thus be separated; and the juice thus purified is to be subjected to the usual mode of clarification and concentration; giving preference, however, to Howard's method. And the patentee claims as part of his invention, the application of steam heat to the evaporation of sugar in vacuo: using high pressure steam at about twenty pounds to the square inch.

Royal Ordinance of France, in relation to High Pressure Engines, (*May 7th,* 1828.)

(Continued from p. 406 of last vol.)

Charles, &c. &c.

Upon the report of our Minister of the Interior;

Having in view the ordinance of October 29th, 1823, in relation to high pressure engines.

By the advice of our Council of State;

We have ordered, and do order as follows:

Art. 1st. The proof-pressure prescribed by the ordinance of October 29th, 1823, is reduced, for boilers of copper or of rolled iron, to triple the pressure to which the boiler is subjected in the ordinary working of the engine. Manufacturers must give such thicknesses to boilers as shall enable them to bear the proof, without injury to the tenacity of the metal.

2nd. The boiler-tubes, for high pressure boilers, are subject to the rules prescribed for boilers, both in relation to proving and to inspection.

When the tubes are of a material requiring a different proof from that of the boiler, they must be proved separately.

In the contrary case, they may be proved with, or apart from, the boiler, as the manufacturer may wish.

In whatever way the proof has been applied, each boiler-tube shall be marked with a number denoting the working pressure of the engine, with the boiler of which the tube is to be connected.

3d. The cast iron cylinders of high pressure engines, and their jackets, must be proved at a pressure of five times that to which they are subjected in the working of the engine. After the proof, both the cylinders and jackets will be marked with the number denoting the ordinary working pressure of the engine.

4th. The pressure to be assumed as unity in determining the proof pressure, must be the bursting pressure to which the boilers, boiler-tubes, cylinders, and jackets, will be ordinarily exposed; that is, the whole working pressure diminished by one atmosphere.

5th. Our Minister of the Interior is charged with the execution of this Ordinance, which shall be inserted in the Bulletin of Laws.

Given, &c. May 7th, 1828.

(Signed,) Charles.

By order of the King.

(Signed,) De Martignac,
Minister of the Interior.

Circular of the 1st of August, 1828, to the Prefects of Departments, in relation to the Royal Ordinances of the 2nd April, 1823, and of 25th May, 1828, concerning boilers used in Steam Boats.

Sir,—You are acquainted with the Royal Ordinance of 25th of May last, (Bulletin of Laws, No. 233, p. 497,) in relation to steam engines used in navigation.

An ordinance, bearing date April 2nd, 1823, prescribed certain regulations for steam boats; the subject required, however, more particular attention. In order the better to secure passengers and the crews of steam boats, as well as merchandise, against accident, it has been found indispensably necessary to place the *low pressure engines of steam boats*, and their boiler-tubes, under the operation of the rules prescribed by the Royal Ordinance of October 29, 1823, in relation to *high pressure engines*, and by the ordinance of May 7, 1828, concerning the boilers and boiler-tubes of high pressure engines.

The use of boilers, or boiler-tubes, of *cast iron* on board of steam boats is prohibited.

The cast iron cylinders of the low pressure engines of steam boats, as well as their jackets, must be proved and marked in the manner prescribed by the ordinance of 7th of May, last, for cylinders, and their jackets, used in high pressure engines.

These are the principal particulars of the ordinance of May 25th, 1828. As they refer to the ordinances of October 29, 1823, and May 7, 1828, I can but call your attention again to the two sets of instructions which I had the honour to transmit to you on the 19th of May, 1825, and 16th of July, last, in relation to the execution of those ordinances. The table of thicknesses for wrought iron boilers, contained in the latter of the instructions referred to, may be used for the boilers now in question. In fact, that table beginning with two atmospheres, is applicable to low pressure boilers. It has not been deemed necessary to give the thicknesses corresponding to a working pressure of one atmosphere and a half, since manufacturers are in the habit of making boilers for so low a pressure thicker in proportion, than for higher pressures.

The Board of Inspection which you were required, by the 1st art. of the ordinance of April 2nd, 1823, to convene, will have new duties to perform. I trust they will see the importance of the new regulations, and will have them strictly executed.

I beg you to communicate to this board the instructions of May 7th, 1825, copies of which I again transmit to you, and of 12th July, last, annexed to my circular of the 16th of the same month.

I further request you to transmit these instructions to the proprietors of steam boats, and to the manufacturers of *low pressure engines for steam boats*, within your department.

They will see that the dies for marking the boilers may be had at the Royal Medallic Mint, Paris, and the fusible metal plates of M. Collardeau, &c.

I have thought it useful to transmit — copies of the ordinances of 2nd April, 1823, and 25th May, 1828, with the present circular. I request you to distribute the copies which I send you to those interested in the subjects of these ordinances.

The Engineers of Mines and of Civil Works are called upon to perform new duties. If I have required of them assiduity in their duties of inspection, and of you constant solicitude, in relation to the establishments where high pressure engines are used, I beg that they and you will take the same pains in the execution of the ordinance of 25th May, last, concerning *low pressure* engines used on board of steam boats.

It is evident that accidents to steam boat boilers, must be of great injury to industry; and more than this, painful to humanity on account of the number of victims, who, cut off from all means of escape, must meet death by the waves, if they should not have been reached by the explosion.

I beg you, sir, to acknowledge the receipt of this.

I have the honour to be, &c. &c.
(Signed,) Becquey,
Counsellor of State, &c.

Royal Ordinance, (1823,) *in relation to Steam Boats.*

Louis, &c. &c.

Upon the report of the Minister of the Interior,

Having before us the law of 29th floreal, year 10, (19th May, 1802.)

Having also before us the decrees of the Prefect of the Gironde, of November 15, 1821, and March 27, 1823, in relation to the police of steam boats running upon the Garonne.

Having before us the observations and opinion of our Minister of Marine, of 27th August, 1822, upon the said decrees.

Having also the opinion of the Board of Civil Works of the 10th of October, following.

Considering that existing laws and regulations, applying to steam boats, do not give sufficient security to the crew and passengers, and that, therefore, it is necessary to resort to special regulations.

Considering, also, that it is important to establish, for the police of steam navigation already introduced upon several streams, general and uniform measures, leaving only to the local authorities the details flowing from these.

With the advice of our Council of State,

We have ordered and do order as follows:

Art. 1st. In all departments containing rivers, streams, or coasts, where steam boats may run, the Prefect shall organize one Board, or more, of practical men, to be presided over either by a chief Engineer of Civil Works, or, in his default, by an engineer of lower rank.

It shall be the duty of this Board, under the direction of the Prefect, to satisfy themselves that steam boats are of due strength, particularly in reference to the engine; that the engine is carefully kept in order, in all its parts, and presents no appearance of special liability to fracture, nor any dangerous deterioration.

2nd. No steam boat can be put in operation until after the Board shall have ascertained the strength of the parts and the good condition of the engine, nor until the Prefect shall have informed the proprietors that he has received and approved the report of the Board.

3d. The Board shall inspect quarterly every steam boat, and shall make a report thereon to the Prefect, in which shall be stated the measures to be pursued in case any defect should appear in the engine. Besides the quarterly visit of inspection, the Board shall make others, whenever directed by the Prefect.

4th. Steam boats are placed, in relation to the number of passengers, the hour of starting, to the composition of the crew, and condition of the vessel, under the regulations in force upon the coasts, rivers, or streams, in relation to navigation. Consequently, when the boats navigate the waters of sea-board arrondisements, the captains must be provided with a permit, or register, and when navigating the waters of inland arrondisements, such boats shall be subject to the inspection of the port officers, as well as to regulations of the Prefect in relation to police at setting out and landing.

5th. The Minister of the Interior is charged with the execution of this ordinance.

Given, &c. April 2nd, 1823.

(Signed,) Louis.

By order of the King.

(Signed,) Corbiere,
Minister of the Interior.

Royal Ordinance in relation to Low Pressure Boilers, used in Steam Boats, 1828.

Charles, &c. &c.

Upon the report of our Minister of the Interior:

Seeing the ordinances of April 2nd, and October 29th, 1823, and of May 7th, 1828.

Wishing further to provide for safety in steam navigation by adding to the general and special regulations, already published, such others as experience has shown to be necessary.

With the advice of our council of state,

We have ordered, and do order as follows:

Art. 1st. The low pressure boilers, viz. those working at, or below, a pressure of two atmospheres, used in steam boats, as well as the boiler-tubes, are placed under the operation of the regulations prescribed, for the safety of the boilers and boiler tubes of high pressure engines, by articles 2, 3, 4, and 5, and the first paragraph of art. 7, of the ordinance of October 29, 1823, and by the ordinance of the 7th of May, 1828.

2nd. The use of cast iron boilers, on board of steam boats, is prohibited under every pressure.

3d. The cast iron cylinders, and their jackets of cast iron, used in the low pressure engines of steam boats, shall be proved and marked as is prescribed by the ordinance of May 7th, 1828, for the cylinders, and jackets, of high pressure engines.

4th. The preceding regulations as well as those of the ordinance of April 2nd, 1823, apply to stationary boats on board of which steam engines are used.

5th. The Board created by the ordinance of April 2nd, 1823, will attend to the execution of the preceding regulations and will make mention of the fact in their report.

6th. In case of infraction of the present ordinance the owners of steam boats will be liable to the recall of their permits, without prejudice to the penalties which may be awarded by the courts.

7th. Our Minister of the Interior is charged with the execution of this ordinance, which will be inserted in the Bulletin of Laws.

Given, &c. May 25th, 1828.

(Signed,) CHARLES.

By order of the King.

(Signed,) DE MARTIGNAC,
Minister of the Interior.

Note upon the Method of Calculating the Thicknesses of Wrought Iron Boilers.

IN the preceding instructions, it was only necessary to give the formula for determining the thicknesses of wrought iron boilers; it has been deemed adviseable to state, in this note, the considerations whence this formula was derived.

It is supposed in what follows that the boiler is a cylinder with hemispherical ends. This form, it is well known, is the best for all boilers, and the only proper one for those of high pressure engines.

In order that a boiler of this form may be equally capable of resisting, at all points, interior pressures perpendicular to a plane passing through the axis of the cylinder, the hemispheric ends must have only half* the thickness of the cylindric part. In practice, the same thickness is, with propriety, given to the ends as to the cylindric part, since the sheets of metal used in forming the ends must be more injured in giving them the required form, than those constituting the body of the boiler. This being the case, it will be necessary to determine only the thickness required for the cylindric part of the boiler: this is given by the following formula.

$$t = \frac{d \times P}{2c} \; \ldots\ldots \; (a)$$

In this formula we obtain the thickness, (t,) in inches if the diameter of the boiler, (d,) has been expressed in inches. P is the whole

---

* Strictly speaking the thickness should be something less, but the difference is so small that it may be disregarded. Let t and t' be the thicknesses of two different boilers, the first being cylindric, the second spherical; all other things being the same in these boilers, and both in vacuo, we shall have

$$t' = t \times \left(\frac{-1 + \sqrt{a+1}}{a} \right)$$

a representing the ratio between the bursting pressure for a given surface and the tenacity of the material for the same surface. In the case in which this force is 7 atmospheres, (of 15 lbs.,) or 105 lbs. to the square inch, and the tenacity 37840 lbs. for the same surface, then $a = .002774840145$, and

$$t' = t \times \left(\frac{-1 + \sqrt{.002774840145 + 1}}{.002774840145} \right) = t \times .4995$$

interior pressure, and c the tenacity of the wrought iron, each being referred to the same amount of surface.[*]

This formula supposes the boiler to be in vacuo, but as it is pressed on the exterior by the atmosphere, the force tending to produce rupture is equal to the elasticity of the steam within, diminished by one atmosphere. Let p represent the pressure upon the unit of surface, and n the number by which the pressure of one atmosphere is to be multiplied to give the tension of the steam within a boiler; the pressure from within is np, that from without p. Consequently the bursting pressure upon a unit of surface is $np—p$, or $p\ (n—1,)$ substituting this value for P in the formula (a,) it becomes

$$t = \frac{d \times p\,(n-1)}{2\,c} \; \ldots\ldots \; (b)$$

The thickness of a boiler calculated by this formula would be too small, since the tenacity of the metal would be just equal to the force tending to burst the boiler. It remains to determine the addition which must be made to this thickness, to suit the circumstances of the case.

To meet the requirements of the ordinance of May 7th, 1828, this value of t should be multiplied by three in order to produce an equilibrium with the proof-pressure, if this product be multiplied by three, the boiler will not be injured by the proof to which it must be subjected. Multiplying the second member of equation (b) by 3×3, or 9, we shall have

$$t = \frac{dp\,(n-1)\,9}{2\,c} = \frac{dp\,(n-1) \times 4.5}{c} \; \ldots\ldots \; (c)$$

If we take the square inch as unity of surface, $p = 15$ lbs.

In the case assumed, c represents the tenacity of rolled iron to the square inch; if the boiler were of copper, c would express the tenacity of the latter metal.

The tenacity of rolled iron is generally taken at 44,000 lbs. per square inch, which is the strength of iron of medium quality.

Below are the results of careful experiments upon the tenacity of hammered iron, of rolled iron, and of copper. The tenacities are referred to the same section, a square inch, and expressed in pounds and decimal parts of a pound.[†]

1. *Iron.*—The tenacity of very good forged iron was 63,780.7 lbs.

Iron of the same quality, but heated to dull redness the tenacity was - - 11,445.3 lbs.

So that the tenacity of this latter is but little more than one-sixth of that of cold iron[‡] of the same quality.

---

[*] The thickness given by formula (a,) corresponds to the only case which it is of importance to consider, viz. that in which the plane of rupture passes through the axis of the boiler. If we suppose the plane of rupture perpendicular to the axis, the case would refer itself to that of a spherical boiler, the thickness of which should, at most, be but one-half that of a cylindric boiler of the same diameter.

[†] These experiments were made by Messrs. Tremery and Poirier Saint-Brice.

[‡] M. Cagniard-Latour was good enough to assist in these two experiments,

2nd. *Rolled Iron.*—Two experiments were made upon rolled iron of the best quality. The first gave for the tenacity of the rolled

iron, - - - - - -	58892.5
The second, - - - - -	56554.6
Total, - - - - -	115447.1
Mean, - - - - - -	57723.5

3d. *Copper*—Sheet copper of excellent quality was submitted to experiment, its tenacity proved to be, - - 38,217.6

It is usually supposed that the tenacity of copper is about two-thirds that of rolled iron, $38217.6 \times \frac{3}{2} = 57326.4$ upon this supposition, a number not much less than that obtained by the experiments, just given, upon rolled iron.

Now if in the formula (c) we substitute for p, its value 15, it becomes $t = \frac{d \times 15\,(n-1)\,4.5}{c} = \frac{67.5}{c} \times d\,(n-1) \ldots\ldots (d)$

It would seem that nothing remains but to substitute for c its value, in order to obtain that of the coefficient $\frac{67.5}{c}$. The remarks which follow will show that such is not the case, and that this coefficient must be determined by considerations of a practical kind.

The number given as that usually taken for the tenacity of rolled iron, viz. 44,000 lbs., would seem, from the experiments given, to be quite small enough. In practice, it is out of the question to take so high a tenacity as the basis of calculation.

In fact if we should make $c = 44{,}000$ in the formula for the thickness, we should have at low pressures, and with small diameters, thicknesses much too small, and the thicknesses would be rather small even for high pressures and large diameters. If we should diminish the value of c in order to have thicknesses which would suit the former of the supposed cases, we should obtain for the high pressures and considerable diameters, such extravagant thicknesses, that they could not be adopted in practice.

The difficulty arises from this, that in the formula reference is had to the force tending to burst the boiler which depends upon the tension of the steam within, that is, upon the value of n. In proportion as n is diminished, t diminishes also, and when $n = 1$, $t = 0$. This case is that of a boiler containing steam of atmospheric tension. Such a boiler is, of course, impossible.

In theory we may suppose sheets of iron to be diminished in thickness indefinitely; but such an idea is purely theoretical, and cannot be realized in practice. It is therefore necessary to set out with a certain thickness independent of the elasticity of the steam within

---

which were made at Clichy, in a laboratory where arrangements were making for the preparation of oil gas, for the purposes of illumination. The iron retorts in which the decomposition of the oil was to be effected were necessarily to be exposed to a dull red heat, and it was important to determine the tenacity of iron at the corresponding temperature.

the boiler, and also to add a thickness, which shall also be independent of the tension within, to make up for the loss of tenacity which the metal undergoes, in being bent, by the temperature to which it is exposed, and by wear. The least thickness which can be added to make up for these circumstances is .12 of an inch, ($\frac{1}{8}$th,) which must therefore be added to the thicknesses given by the formula.

We must now determine the value which $\frac{67.5}{c}$ should have in order that the thicknesses calculated by the formula and increased by .12 inch should suit all diameters of all tensions, and should agree, as nearly as possible, with the thicknesses usually given by the best manufacturers to their boilers, made to stand a long continued use.

It has been found that all these conditions may be satisfied by making $\frac{67.5}{c}=.0018$, which supposes for rolled iron a tenacity of 37,500 lbs. per square inch.

Substituting this value for the coefficient in formula (*d*,) and adding the constant thickness of .12 of an inch, we shall have

$$t = .0018\, d\,(n-1) + .12 \,.\,.\,.\,.\,.\, (e)$$

It has been remarked above, that the tenacity of the best rolled copper proved to be 38,217.6 lbs.; this number is rather higher than that, (37,500,) deduced from the coefficient .0018 of the formula (*e*,) this formula, therefore, may be used to determine the thicknesses of copper boilers, a condition which it was important to fulfil, since, for the reasons set forth in the instructions, manufacturers usually give no greater thicknesses to copper than to iron boilers. As, however, the number 37,500 is but little less than that given by experiment for the best varieties of copper, and as the tenacity of certain varieties may be lower than this, it will be necessary, according to the quality of the copper, to increase the thickness given by the formula, by about one or two-tenths of the thickness found.*

It results from the remarks contained in this note that for different values of *d* and *n*, the formula (*e*) will give the thicknesses, by the comparison of which in any given case with the actual thickness of a boiler, it may be ascertained whether, or not, this boiler can withstand the required proof without injury. Manufacturers by governing themselves by these thicknesses will not throw into use boilers incapable of bearing proof, after long continued wear. In this way they will be preserved from the ill effects which would result, if their boilers were condemned, by the engineers, in the annual visits of inspection required by the 7th article of the ordinance of October 29th, 1823. T.

---

* According to George Rennie, the tenacity of hammered copper is but 36.531.6 lbs. per square inch.

On the First Invention of Telescopes, &c.—By Dr. G. Moll, *of Utretcht.*

(Concluded from page 336, vol. 7.)

Having heard what was adduced on the side of Lippershey, we must now turn to the witnesses of Zacharias Tausz, of Taussen.

The first of these is the ambassador Boreel himself, a man alike respectable for his rank, character, and abilities. He says, that in 1591, the year in which he, (Boreel,) was born, a spectacle-maker lived near his father's house at Middleburg; that this man's name was Hans, his wife's Maria, and that, besides two daughters, he had a son called Zacharias; that Boreel knew this Zacharias intimately, they having been playmates. This Hans, *i. e.* John, with his son Zacharias, as *Boreel often heard*, invented the first *microscope*, which was presented to Prince Maurice, and they obtained some reward. A similar *microscope* was afterwards offered by them to the Archduke Albert of Austria. When Boreel was ambassador in England in 1619, he saw that identical microscope there, in the possession of Cornelius Drebbel, of Alkmar, a man of much knowledge, and mathematician to King James, the Archduke having presented the microscope to Drebbel. This microscope of Zacharias was not, continues Boreel, as they are shown at present, with a short tube; but it was about eighteen inches long, and two inches in diameter, with a tube of gilt copper, resting on two sculptured dolphins; under it was a disc of ebony, on which the objects to be examined were placed.* But long after, in 1610, by dint of research, they, (*i. e.* Hans and Zacharias,) invented in Middleburg the long sidereal telescopes, with which we gaze at the moon, the planets, stars, and heavenly bodies, of which a specimen was given to Prince Maurice, who kept it secret, judging it useful in expeditions. However, as this admirable invention was rumoured about, and as curious men were talking about it in Holland and elsewhere, a stranger came from Holland to Middleburg to inquire into this matter, and, asking for a spectacle-maker, he was shown, by mistake, into the shop of John Laprey. He spoke with him about the secret of the telescope. Laprey, being an ingenious man, and a close observer, heard attentively what the stranger said, and thus, with laudable industry and care, became the second inventor of the long telescope, which he made to the satisfaction of the stranger. Therefore Laprey, who by his ingenuity discovered a thing which was not shown to him, deserves to be ranked as second inventor. He first sold telescopes, and made them generally known. Afterwards, Adrian Metius, Professor of Francker, and, later, Cornelius Drebbel, came to Middleburg in 1620, and bought each a telescope, not from Laprey, but from Zacharias Tausz.

From this evidence we may infer, that Hans, or John, and his son Zacharias, were actually the inventors of a compound microscope for opaque objects: the elegant ornaments of this instrument, and the general description which Boreel gives of it, make it probable that both Hans and Zacharias were men of ability. But with microscopes we have at present nothing to do. The point at issue is, whether either Hans or Zacharias, or any body else, actually made telescopes before the second of October, 1608; and since Boreel indicates 1610 as the epoch of the invention of Hans and Zacharias, the claim of Lippershey to priority remains unshaken, even by the evidence of Boreel.

---

* A stage.

The following witness is John, the son of Zacharias, and consequently grandson of this Hans, of whom Boreel has spoken. He says, in 1655, that he then was fifty-two years old; thus, at the period when Lippershey sent in his petition, *i. e.* in 1608, he was only five years old. He does not mention his grandfather, but says, that his father, Zacharias, was the first inventor of the telescopes; and that this happened, as he *had often heard*, in this town, in 1590; but the longest telescope made at that time did not exceed in length fifteen or sixteen inches. He affirms that two such telescopes were *then* offered, one to Prince Maurice, the other to the Archduke Albert; and that telescopes of such length were in use till 1618. At that time, he, John, and his father, Zacharias, invented the construction and fabric of the longer telescopes, which are still now used at night to look at the moon and stars. He further says that, in 1620, a man of the name of Metius came to Middleburg, and procured such a telescope, the construction of which he afterwards tried to imitate; and he adds, that Drebbel did the same.

This witness, fixing the epoch of the invention at 1590, speaks only from hearsay. Besides, he is in contradiction with Boreel, who states that the invention of the telescope by Hans and Zacharias was in 1610, at which time Boreel was nineteen, and this John Zacharias only seven years of age. John says nothing of the microscope, which Boreel actually saw and described. It is certainly possible that one of the Metii, perhaps the Professor, came to Middleburg in 1620, and bought a telescope. But this does not decide the question of priority, as we know, from incontrovertible authority, that Jacob Metius was in possession of the invention in 1608. What happened in 1620, when so many splendid discoveries were made by means of the telescope, is not of the least consequence, as far as concerns the first invention of the instrument.

There still remains another witness, whose evidence is very immaterial and of little importance. It is a woman called Sarah Goedard; she is a sister of Zacharias Jansz: she merely says, that it is forty-two or forty-four years ago since her brother invented the long telescopes in Middleburg. She often saw her brother at work making telescopes; but she cannot speak positively as to time.

This woman's evidence, who brings the invention to 1611 or 1613, cannot be of the slightest use in settling the question between Zacharias and Lippershey.

It was then the soldier of Sedan, who first brought the instrument to France; but his endeavours met with no great success in that country. It is most astonishing to find the French philosopher Peirese doubting the truth of the invention of telescopes at late as 1622, and ascribing it to Drebbel, a person wholly unconnected with it. In a letter to William Camden, he says, "I should like to know what is true about the inventions of Cornelius Drubelsius Alkmariensis, who, as is said, has invented in your parts a globe representing ebb and flood, a covered boat going between two waters, and long *spy-glasses, (lunettes,) with which a writing may be read at the distance of a league, which we do not easily believe here.*"*

And in another place† he says, "we are told marvellous things here about the invention of Cornelius Drubelsius Alkmariensis, who is in the service of the king of Great Britain, and who lives in a house near London; amongst others a covered boat, which goes between two waters; a glass globe, which he makes to represent the tides, by a perpetual motion, regulated like the natural tides of the sea, *and of a spy-glass which makes one read a writing at more than a league,* (or a mile,) *distance.* I beg you to write me a word about the truth of each of these inventions. We have here those small glasses, (lunettes,) by which insects and mites appear as large as flies, which is certainly admirable; but I should like to know what is true respecting these other inventions."

It would appear that the invention was attributed by some persons to the soldier of Sedan, whose name appears to have been Crepi.‡ He left, as we have seen, the Low Countries in December, 1608, and in May following, 1609, we find a Frenchman in Milan making telescopes. Sirturus§ gives us the following account of this transaction.

"A Frenchman hurried to Milan in May, 1609, who offered a telescope to the Count de Fuentes. He called himself a partner of the Dutch inventor. The Count gave the instrument to a silversmith, to have it included in a silver tube; it fell into the hands of Sirturus, who handled and examined it, and made a similar one, (if his assertion is to be believed;) but perceiving that much depended on the glass, he went to Venice to get some at the workmen."

Simon Marius, who disputed the discovery of the satellites of Jupiter with Galileo, speaks of another Dutch telescope, which came into foreign parts at a very early stage of the invention. He says that in 1608, at the autumnal Franckfort mass, or fair, (usually held in September,) a certain General Fuchs de Bimbach, an amateur of mathematics, heard from a Dutchman then at the fair, that an instrument had been invented which magnified objects and made them appear near. He wanted to procure one of these glasses, but the Dutchman asked too high a price; but being returned to Onoldsbach, Fuchs told the circumstance to Marius; adding that the instrument had two glasses, one convex and one concave, of which he even drew the figures. Marius adjusted glasses of this form, and convinced himself, to a certain point of the possibility of the thing; but his object glass was too convex. He ordered some other glasses of the opticians of Nuremberg; but he could procure none that suited his purpose. The next summer, of 1609, Fuchs got a tolerable instrument from Holland, which he used with Marius in examining the heavens. About the beginning of 1610, Fuchs got two well polished glasses from Venice, where they had been worked by T. B. Lanccius, recently returned from Holland.

---

* Gul. Camdenii et ill. viror. ad Camden. Epistol. London, 1691, p. 333.
† Page 387.
‡ Borel de verotelescopii inventore, p. 19.
§ Sirturus de telescopie, Edit. Frankf. 1618. 4to. minori, p. 25.

If the account of Marius deserves credit, the person who brought the telescope to the Franckfort mass, or fair, in September, 1608, did so a short time before Lippershey presented his petition to the States, which was done the 2nd of October of that year. Fuchs, certainly with great reason, thought the Dutch telescopes high priced; we have seen Lippershey asking a thousand florins for one.

We are indebted to the English author of the *Life of Galileo* for an instance of another Dutch telescope being brought to Italy. Lorenzo Pignoria writes to Paolo Gauldo, from Padrea, the 31st of August, 1609, "We have no news, except the return of his Serene Highness, and the re-election of the lecturers, among whom Signor Galileo has contrived to get 1000 florins for life, and it is said to be on account of an eye-glass, like the one which *was sent from Flanders to the Cardinal Borghese.* We have seen some here and they succeed well."

It will, after all, be very difficult to deny, that not only the rumour of the invention, but even some telescopes actually made, reached Italy from Holland, before Galileo ever made such an instrument. In May, 1609, there was a telescope in the hands of the Count de Fuentes. Another was in the possession of Cardinal Borghese; Lanccius, who came from Holland, is said to have made telescopic glasses at Venice; Fuccarius distinctly says, that one Dutch telescope was brought to Venice, and *that Galileo saw it.*[*] But such is our respect for the genius and character of Galileo, that his mere assertion that he never saw a telescope when he set about making one; that he did not know its construction; that his friend Jacob Badorere, by whom he got intelligence of the invention from France, did not give him any information of the manner in which it was made—his simple assertion of all this is taken by us as conclusive against any presumption.

Nelli, in his *Life of Galileo*, says that the Florentine philosopher first heard of the invention in June, 1609. Galileo himself informs us, in a letter written in March, 1610, that he heard of the invention about ten months ago, which would fix the time of his first attempt to the month of May, 1609, the time when, we know from Sirturus, that a Frenchman brought a telescope to Milan.

Even after the very able manner in which the history of Galileo's discoveries have been recently given by an English author, it will not be superfluous to give Galileo's own account of the transaction. In March, 1610,[†] he wrote in the following manner:—"It is about ten months ago that it came to our ears, that a glass* had been worked by a Belgian, by the help of which, visible objects, though at great distance from the eye of the observer, may be seen distinctly. (In the Italian of the saggiatore it is added *ne piu aggiunto, no more was added*, or *this was all.*) And some experiments were related of the admirable effects of this instrument, which some believed, and others not. A few days afterwards the same was confirmed by letters of a noble Frenchman, Jacob de Badorere, from Paris; all which occasioned me to apply myself wholly to inquire into the cause of this, and to think on the means by which the invention of a similar instrument might be brought about; in which I succeeded in a short time, assisted by the doctrine of refraction: and I first procured a leaden tube, at the end of which I adapted spectacle glasses,† both plane on one side, the one convex on the other side, the second concave. Bringing the eye near the concave glass, I saw the objects large, and near enough: they appeared three times nearer, and nine times larger, than if seen with the naked eye.

---

[*] Kepleri. epistolæ, No. 309, p. 493.

[†] Epist. 4. Td. Martii, 1610.

"Afterwards I made another instrument, which made objects appear sixty times larger.

"Finally, sparing neither industry nor expense, I succeeded so far as to make an instrument of such excellence, as to make the objects seen through it, appear a thousand times larger, and more than thirty times nearer, than if seen with the natural power of the eye."

Viviani, Galileo's favourite pupil and friend,‡ says that in the month of April or May, 1609, it was rumoured in Venice, where Galileo then was, that a Dutchman presented to Count Maurice, of Nassau, a certain glass occhiale, with which distant objects appeared as if they were nearer, *nothing more was said.*§ With this information only Galileo returned immediately to Padua, to try whether he could find out the construction of this instrument, in which he succeeded on the following night. The next day was employed in constructing the instrument, in the manner which he had imagined; and, notwithstanding the imperfection of the glasses which he procured, he saw the effects which he anticipated, and immediately gave notice of it to his friends in Venice. He constructed, after this, instruments of better quality; and six days later he took some of them to some elevated part of the city, and made the first senators of the republic observe distant objects, which they did with great admiration. Bringing constantly the instrument to greater perfection, he resolved finally, with his wonted liberality, to communicate his invention, and to make a free gift of it to the serene Prince and Doge Leonardo Donati, and to the Senate of Venice, presenting with the instrument a paper, in which he declares the construction, and the admirable use and results on *land and on sea*, which might be obtained from this invention. In consequence of this noble present, the serene republic, with generous demonstration of the 25th of August, 1609, wrote to Galileo, and a pension was granted him for life, with more than three times the salary, which it was the custom to give to a lecturer of mathematics.

---

* Un occhiale, perspicillum.

† Vitrea perspicilla.

‡ Viviani vita del Galileo, p. 69.

§ *Ne piu oltri fu detto.*

Thus we perceive the Venetian Senators doing in August, 1609, the same thing which the members of the states-general had done in October, 1608, about ten months sooner. They ascended to high places for the purpose of gazing at distant objects. Both the Dutch and the Venetian magistrates nobly rewarded the invention, which was tendered to them. The Venetians rewarded Galileo as a philosopher should be rewarded, by an honourable station and independence. The Dutch treated Lippershey in the best way an artist can be treated; they gave a high price for his article, and made large orders for it. The date assigned by Viviani to these transactions, the 25th of August, 1609, agrees completely with what Lorenzo Pignoria wrote the 31st of August to Paolo Gualdo, and which letter was mentioned above.

It is exceedingly gratifying to observe, that Galileo almost immediately brought the telescope with a convex object-glass and a concave eye-glass, to all the perfections of which it is susceptible, without being achromatic. He observed with it all that could be seen by its means; he ascertained the power of his glass with great ingenuity, and he indicates the difference between linear and superficial amplification with perfect accuracy. His German biographer Tagemann, does not seem to have clearly understood this difference, for he appears to imagine that Galileo's telescope really had a power of 1000 times, whereas it was only of about 32.

In a Galileon telescope the focal length of the object-glass cannot go beyond a certain extent, without narrowing the field too much. The eye-glass cannot be made very deep without making it too thin in the centre. Even at present it would, perhaps, be difficult to make Galileon telescopes of greater power than 32, which is, indeed, that which Galileo obtained.

On the 7th of January, 1610, Galileo discovered three of the satellites of Jupiter; on the 13th, the four satellites were observed and recognised as satellites; but it is not my object to enter into that splendid train of discoveries which illustrated the name of Galileo, and which lately have been so well described. However perfect we allow the instruments of Galileo to have been, we see no reason to doubt that the satellites could be seen with the instruments made in Holland. The Italian authors certainly assure us that the Dutch telescopes were of an inferior description; but this assertion is wholly unsupported by proof. Indeed we know nothing of these telescopes except that they were long, (*tubi longi*,) and longer than 16 inches;* and it is not unrational to suppose, that with this length, they were equal to Galileo's telescopes. Admitting the length of the telescope to have been sixteen inches, and the negative focus of the concave eye-glass half an inch, the power of the telescope was 32, or equal to that of Galileo. The Professor Adrian Metius,† brother of the co-inventor of the telescope, gives us some account of what could be seen with the telescopes then made in Holland. In a book printed in 1614, he says, "During the day several planets are observed near the sun, which were unknown hitherto to all men, but which can only be seen with the glasses, which my brother, Jacob Adriaansz, invented six years ago, (thus in 1608.) These planets show themselves first in the eastern part of the sun, and from thence pass over the sun to the westward, in about ten days, as I observed several times, principally about sunrise and sunset.

---

* De vero telescopii inventore, p. 30.

† Adriani Metti, Institut. Astronom. et Geograph. Francq. 1614. Fondamentale en grondelyche onderuysinge, ibid 1614. Adriani Metii tractatus de genuino usu utrusque globi, Francq. 1624. 4to.

"With these same tubes some erratic stars or planets are seen, which have their course round Jupiter; but of these nothing can be stated with certainty, unless my brother be pleased to publish his telescopes, by means of which many strange things will be brought to light, as well about the moon as elsewhere. Yea, the observations of the stars may then be made with much greater accuracy; because, by means of these telescopes, it will not only be possible to observe minutes, but even seconds."

It does not appear from this quotation that the professor himself observed the satellites; nor does he even appear to be aware of their number. His brother Jacob, perhaps, gave him some incomplete information of the existence of the satellites. But *he saw* the spots of the sun, which may be seen with instruments of a less power; and he labours under the erroneous notion then common to many, that the spots were planets or satellites revolving round the sun.

But what the Professor says of *the accuracy* which the invention of the telescope is likely to insure to astronomical observations, is very remarkable. What does he mean by asserting, *that the observations on the stars will become accurate to a second?* Did the pupil of Tycho anticipate the application of the telescope to instruments of mensuration; to quadrants? I must own that it is difficult to take his distinct words in any other sense; and I am led to believe, that the idea of an invention, which did so much credit to Gascoigne, had occurred to Adrian Metius.

There is a passage in the English Life of Galileo, which ought not to pass unnoticed. The anonymous author accuses William Boreel, to whom he chooses to give the Italian name of Borelli, of glaring partiality against Galileo. "Borelli," says this author, "not satisfied with attributing the invention of telescopes to Zanssen, endeavours to secure for him and for his son the more solid reputation of having anticipated Galileo in the useful employment of the invention. He has, however, inserted in his collection a letter from John, the son of Zacharias, in which John, omitting all mention of his father, speaks of his own observations of the satellites of Jupiter, evidently seeking to insinuate that they were earlier than Galileo's; and in this sense the letter has been since quoted, although it appears from John's own deposition, preserved in the same collection, that, at the time of the discovery, he could be no older than six years. An oversight of this sort throws doubt on the whole of the pretended observations; and, indeed, the letter has much the air of being the production of a person imperfectly informed on the subject on which he writes, and probably was compiled to suit Borelli's purposes, which were to make Galileo's share in the invention appear as small as possible."

I crave the liberty of replying to this passage, that if probabilities are to be introduced in the case, it seems extremely probable that the learned author of the Life of Galileo has never read Borel's book with sufficient attention, and, as the book is scarce, he knows it perhaps only from quotation. There is *no letter* inserted in it from John, the son of Zacharias; but in answer to some queries either from Boreel or from Borel, he gives two memorials or notes of what a telescope of his making could show. In the first place, he mentions the appearances and dark places in the moon; and it is to be observed, that what he says of the appearance of the moon seen through his telescope, answers exactly to what one would expect of a good instrument. It plainly shows, says John, the moon to be a sphere, with distinct edges, and not a plane. The following is his statement of Jupiter's satellites: he often observed the planet which shows itself round, well defined and spheric; near it he often saw two highly situated small stars, sometimes he saw three, and generally four of these small stars. As far as he could observe, they go perpetually in circles round Jupiter; but, he adds, this I leave to astronomers to determine, for it is not, says he, my business to make astronomical observations, but to furnish astronomers with telescopes as good as I am able to make.

I challenge the author of the Life of Galileo to point out the passage in Borel's book in which either Boreel, or John, the optician, exhibit the least intention of throwing Galileo's discoveries in the shade. But it may be permitted, I should think, to an optician, when asked by an ambassador at a foreign court, to state what the performances of his instrument is; and I believe that neither Mr. Dollond nor Mr. Tully could be justly accused of disparaging Sir William Herschel's merit, if they were to state that the Georgium Sidus is visible in their telescopes. John certainly says, in 1655, when he was fifty-two years of age, that he often saw four satellites with a telescope of his own making; but he never says that he saw the satellites before January, 1610, the epoch of Galileo's discovery, nor does he even mention *when* he first saw them. He is, he says, no astronomer, but an optician; and when this optician states, in 1655, that he makes telescopes with which the satellites can be seen, it is difficult to understand how it can be inferred that he made this statement in order to deprive Galileo of the honour of discovering the satellites in 1610. Thousands, certainly hundreds, saw the satellites in 1655; and why should not John, like other people? I, therefore, positively deny that any intention is shown in Borel's book, to depreciate the merits of Galileo; and as far as Boreel is concerned, considering his character and station in life, it is absurd to say, *that his evident object* was to make Galileo's share in the invention as small as possible; but if Boreel really undervalued Galileo's merits, let the English author quote, and point out the place *where* he did so. I must offer another remark on this same anonymous author. I am quite prepared to believe that the telescopes made by Galileo's own hands were as perfect as art could make them at the time; but it is to be lamented, if the original telescope of Galileo still exists in Florence, that no Italian philosopher has favoured us with an account of its performance. We have, however, a sort of criterion of what could be done by it. The belts of Jupiter were, as far as I know, never seen by Galileo; they were observed, after his death, or blindness, with instruments made by Evangelista Torricelli. But the author of the English Life of Galileo asserts, as proof of the inferiority of the Dutch telescopes, that in 1637, *Gaertner, or as he chose to call himself Hortensius,* wrote to Galileo, that no telescope could be procured in Holland, sufficiently good to show Jupiter's disk, well defined."* Hortensius wanted more than could be accomplished in his time; and even now, telescopes of a certain size, which show Jupiter's disk well defined, are not of every day's occurrence. Does this author know many telescopes excepting those made by Mr. Dollond or by Mr. Tully, capable of showing Jupiter's disk, *well defined;* nay, does he know one single telescope, *not achromatic,* capable of answering the claim of Hortensius. The anonymous author favours his readers with a translation of Hortensius name, which he pronounces to be *Gaertner.* He is mistaken, however: Gaertner certainly is the *German* of Hortensius; but he was *not* a German, and his name, in his mother tongue, was Van den Hore.

We find the celebrated Peirese, as late as 1622, doubting the invention of telescopes: in England, these instruments were known at a much earlier period. The celebrated English mathematician, Thomas Harriot,† actually observed the satellites of Jupiter, as early as the 10th of January, 1610, which is only *eleven days* later than Galileo's discovery. It is, indeed, astonishing, that an *English author* should overlook this circumstance. Harriot also observed the spots in the sun for the first time, on the 8th of December, 1610. They were first seen by Galileo in November of the same year. Harriot's telescopes had, it appears, powers of 10, 20, and 30. His observations run from the 16th of January, 1610, to the 26th of February, 1612; he gives drawings of the configurations and computations of their revolutions. Now, it may be asked, from whence did Harriot get the telescope with which he observed the satellites only a few days later than Galileo? Certainly not from Italy; he either made it himself, or got it from Holland.

But a few months later we find another English astronomer furnished with a telescope. Sir Christopher Heydon writes, on the 6th of July, 1610, to the well known William Camden:—"I have read Galileo, and, to be short, do concur with him in opinion; for his reasons are demonstrative; and of my own experience, with *one of your*

---

* Page 25.

† These observations and other manuscripts of Harriot, were discovered in 1784, by Baron de Zache, at Petrowth, in Surry, the seat of Lord Egremont. See Bode's Astronom. Tahrbuch, 1788, p. 155, Monatliche Correspondenz, t. viii. p. 144.

ordinary trunks, I have told eleven stars in the Pleiads; whereas no age ever remembers above seven; and one of these, as Virgil testifieth, not always to be seen.*

Telescopes were then, it appears, called *trunks*. Harriot, in his letters to Henry Percy, Earl of Northumberland, calls them *perspective cylinders*. It appears that the Earl possessed many of them, and that he wanted some more. It is to be lamented that Harriot's papers and manuscripts are at present buried in one of the libraries of the University of Oxford.

From all which has been said in this paper, the following facts may be established, as proved by authentic documents:—

That on the 2nd of October, 1608, John, or Hans Lippershey, a native of Wezel, a spectacle-maker of Middleburg, in Zealand, was actually in the possession of the invention of telescopes.

That, on the 17th of October, of the same year, 1608, Jacob Adriaansz, sometimes called Metius of Alkmar, in Holland, also was in possession of the art of making telescopes, and that he actually made those instruments; but that either from disgust, or some other reason, he afterwards concealed his invention, and thus actually gave up every claim attached to the honour of it.

That there is little reason to believe that either Hans, or his son, Zacharias Zansz, were also inventors of the telescope; but there is every probability that this Hans, or John, or his son Zacharias Zansz, invented a compound microscope about 1590.

That this Lippershey used rock or mountain crystal in the construction of telescopes, and that he is the inventor of the Cinoculus.

[*Jour. Royal Institution.*

On substituting Plates of Fusible Metal for Wood Blocks in Calico Printing, &c.—By M. G. ENGELMANN.†

THE engraving of wood blocks for calico printing is very expensive, and these blocks being also formed of an hygrometric substance, are continually subject to change from swelling and shrinking by the effects of moisture and dryness, and thus occasion a considerable loss of time; and give false impressions from the trouble of replacing them, and the consequent inequality in their adjustments. I have therefore endeavoured to substitute for them a substance which is not liable to swell by the action of humidity; can be moulded with great accuracy, and at the same time is capable of resisting the effects of the blows of the mallet, and of the acids contained in certain of the colours used in calico printing. The fusible alloy appears to me to offer these advantages, and I employ the *en cliché* process in its application.

I operate in the following manner:—Having made an engraving in wood on a piece of plank, and given a sufficient breadth to the bottom of the lines to enable the cast to part from the mould, I interpose between the metal and the wood a substance which shall facilitate their separation; to effect this, I brush over the engraving a mixture of ground *sanguine,* (red chalk,) and water. I then finally affix the engraved block to the bottom of the upright slide or stem of the stamp, and let it fall suddenly upon the melted fusible alloy at the moment when it is just upon the point of becoming solid, or has acquired a *pasty* consistence, I thus obtain a counter proof of the engraving. This counter proof serves as a matrix or mould for the engraved plates of fusible metal which I intend to make. For this purpose I affix it to a piece of wood, and surround it with a border of metal, intended to determine the thickness of the metal plates struck in it, and which border is also formed in such a manner, as that whether placed on one side or the other it shall exactly fit; I then firmly affix this matrix, thus surrounded with its frame, upon the bottom of the stem of the stamp, and strike another counter proof *en cliché,* and so proceed until I have thus produced enough of them to compose and to cover a calico printing block.

---

* Gulielmi Camdeni et illust. viror. ad G. Camden. Epistol. London, 1691, p. 128.

† From Bullet. de la Soc. Indust. de Muhlhausen; and Feurressac's Bulletin des Sciences Technologiques.

These second counter proofs thus obtained, I place, with their engraved faces undermost, the one by the side of the other, upon a flat surface, and also shape and dispose them with the necessary regularity to insure precision in the impressions from them; I then pass a heated iron along the joints in order to solder one piece to another, and then fix the whole upon a wooden plank by means of copper nails, but I previously varnish the plank to prevent moisture from penetrating it. These blocks, if I may judge from the two experiments which I have made with them, offer no other inconvenience than being a little heavier than those made entirely with wood; they differ, however, but little from those blocks in which the raised parts are made with brass or copper,—a difference trifling in comparison with the great advantages they possess in not being liable to change from the action of moisture.

It is easy to see that a calico printing-block thus constructed must cost much less than one engraved upon wood, and especially as we need only to engrave a segment, or one of the parts, which are usually repeated a great number of times; and to multiply them by the *clichage,* an operation which will produce in less than an hour more casts than are sufficient to fill a block thickly covered with them. The value of the metal employed, and which need not be more than a line in thickness, is a mere trifle, and after the block has done its work may be remelted. We can preserve the small matrices which occupy but little room, and when we require to make another block it can be done quickly. It is also equally easy, in changing a moulded pattern, to vary the position of these small casts, since we can either bring them near together, or remove them to a distance apart; place them in a line, or mingle one piece with another, and thus either form them into borders, or employ them in the interior parts of the prints.

If we compare the price of these blocks, with those whose raised parts are formed of brass or copper, it is greatly in their favour; and we have no doubt that in the hands of skilful persons, the art of forming them by means of *clichage*, will obtain as great perfection as those blocks possess. [*Repertory of Inventions.*

Mordant for Calico-Printers.—By Mr. FRANCIS DAVIS, *of Cold Bath Square.*

From the Transactions of the Society of Arts.

MR. FARADAY has already noticed, in a periodical publication, the property which solutions of the salts of uranium possess, even with a superabundance of acid, of producing a red stain on turmeric test-paper, similar to that which is produced on the same paper by solutions of the alkalies. By pursuing Mr. Faraday's inquiries further than it appears that he himself carried them, I found that solutions of the salts of this metal give a reddish brown colour to paper made yellow by French berries, fustic, quercitron bark, and weld, as well as to paper impregnated with infusion of nut-galls. This suggested to me the possibility of adding to the mordants at present in use, one, which, when printed on calico, &c. would give, with the above-mentioned drugs, by means of the same copper of dye, an additional colour, and thus add a considerable variety to patterns of cotton-prints, without the trouble employed in dying them being at all increased.

The mordants at present in use, and the only ones, I believe, ever used in cotton-spinning, are alumina and the buff or deutoxide of iron. These are applied to the cloth, united with acetic acid, but are not fixed in it upon the same principle.

Acetate of alumina is of such a nature that, when its solution receives a high temperature, say about 212° Faht. part of the alumina is deposited. Being laid on cold, the cloth is afterwards passed round heated tubes, and thus alumina is deposited in intimate union with the fibre of the cotton, &c.

The case is somewhat different with respect to the iron mordant. The iron liquor, or solution of acetate of iron, contains this metal in the state of a protoxide, which is very soluble in acetic acid; and if, in this state, it be exposed to the atmosphere, a larger portion of oxygen is acquired, and the deutoxide of iron which is then formed being less soluble, precipitates. After the iron mordant has been applied to the cloth, it is necessarily exposed to the atmosphere, and consequently the oxide of iron is precipitated and fixed in it.

The oxide must be fixed in the cloth, that the latter may, before being put into the dye-bath, go through the cleansing processes to which the manufacturer is obliged to subject it after application of the mordant.

The oxide of uranium, before it can be applied as a mordant, must also be intimately combined with the fibre of the cotton, as I have shown to be the case with the others. I found that the acetate of uranium possessed neither the property of the acetate of alumina, nor of that of iron, and was in all respects unfit for the purpose required. It therefore became necessary to search for some liquid combination of uranium, which should resemble, in its mode of action, one or other of those salts. As the three following solutions all possess the property of acetate of alumina, they appear to me to be well adapted to obtain the end proposed.

The yellow oxide of uranium (called by some the peroxide) is soluble with heat, in a solution of

The sub-carbonate of ammonia;
The bi-carbonate of soda; and
The bi-carbonate of potass.

To one or other of the above solutions, saturated with oxide of uranium, and become *cold*, add strong acetic acid in sufficient quantity to saturate the ammonia, soda, or potass employed; as, for example, to prepare the one in which the carbonate of soda is used, dissolve two parts by weight of this salt in sixteen parts by weight of water; this solution, boiled in one part by weight of oxide of uranium in powder, will dissolve it: when cold, add five parts, also by weight, of strong purified wood vinegar of commerce; agitate the mixture. The quantity of acetic acid added must of course depend upon its strength.

When the acid is added to the solution of the oxide, in any one of the above-mentioned salts, the transparency of the solution is not disturbed, nor is any of the oxide of uranium deposited; but if it be made to boil, it will exhibit the same property as a solution of the acetate of alumina, by becoming turbid; and if the ebullition be continued for a short time, the whole of the oxide of uranium will be precipitated, leaving, when the oxide has had time to settle, a colourless, supernatant liquor. This liquor being entirely colourless, may be considered as a criterion of the acid having been added in proper proportion to the other ingredients; for the liquor will retain a yellow colour, if the acid be added in too great or in too small a quantity.

Any one of these solutions, thus prepared, when mixed up with gum, and laid by a pencil on cloth, and this afterwards passed through the same heating process as that used for it when prepared with acetate of alumina, will be found to deposit the oxide so firmly in the fibre of the cotton, &c. as to qualify it to bear any cleansing to which the calico-printer may find it necessary to subject it. With respect to which of these solutions may be best adapted for this purpose, I think it likely that the one made with the sub-carbonate of ammonia will be found preferable; but as in this communication I intend to confine myself to that of which my experiments qualify me to treat, so I feel diffident in pronouncing positively upon the relative merits of these solutions, because, when used by me, they were only pencilled upon the cloth, instead of being impressed by the block of the calico-printer.

An obvious way of precipitating the oxide in the cloth must suggest itself to any person acquainted with the nature of metallic salts; namely, by printing the cloth with any of the soluble salts of this metal, and then dipping it into a solution of an alkali, or lime-water. There are many very serious objections to this mode of effecting the end proposed. I shall confine myself to stating two: first, it would be introducing an additional manipulation—an inconvenience which will be avoided by the use of the solution of the oxide in the alkaline carbonates above proposed; secondly, when a piece of cloth, treated by me in this way, was passed through a dye-stuff, it was found to have received the colouring matter very unevenly, and exhibited a fainter colour than that imparted by the same dye-stuff to places mordanted by the solutions of the oxide in the carbonates, although a greater quantity of oxide was, to all appearance, fixed in the cloth by treatment with the alkali than by the other way. In this manner, indeed, a very permanent bright yellow colour, a circumstance which ought not to be lost sight of by the manufacturer, may be produced in cloth, without its undergoing any other preparation.

With Nutgalls.

In infusion of nutgalls solutions of the salts of uranium occasion a brown precipitate: it was therefore to be anticipated that the colour given by this dye to the uranium mordant would be the same. The colour received is, in fact, a dull brown. This appears to be as permanent as the black produced by iron, and stands washing as well. When used in conjunction with the iron mordant, colours having all the varieties that can be formed from these two may thus be produced in the same bath of dye. To ascertain whether the brown colour of the uranium mordant was produced by the same principle (generally considered as the gallic acid) which produces black with the iron, a piece of calico, previously dyed brown by uranium and galls, after being thoroughly washed, was boiled in a solution of muriate of iron, and, as might have been expected, was by these means changed to black.

With Weld and Quercitron Bark.

The colours obtained from these dying drugs resemble one another in every respect. They are yellow, brown, or faded-leaf colour: they appear as permanent in the sun's rays as the yellow that is given with alumina, and will stand washing. If uranium, alumina, and iron, be used together, a bright yellow, light brown, and dark olive green, as well as all the various combinations of these three colours, may be obtained by one bath of these dye-stuffs at the same time. This brown colour gave the same indications of the presence of gallic acid as the one from nutgalls, when treated with solution of muriate of iron.

With Fustic and French Berries.

But the most valuable property of the uranium mordant is, its producing, with the above articles, a very agreeable and permanent colour, varying from a light red to a chesnut colour. The colour from French berries approaches nearer to pink than that derived from fustic. It might be imagined that the gallic acid is concerned in producing these colours, as well as the ones obtained from weld and quercitron bark, as the infusion of both fustic and French berries will give a black precipitate with a solution of iron, in the same manner as the infusion of weld or of quercitron bark; and they are also, as well as the two latter, capable of giving an olive-green colour with the iron mordant. But, notwithstanding those strong grounds for supposing that the colour produced by fustic and French berries is a compound of gallic acid and uranium, when tried by the test before mentioned, of boiling with a solution of iron, the colour was found to be very little, if at all, altered. The calico-printer will find, by the use of the uranium mordant, that he will be enabled to print a very permanent, and, as I think, a very desirable colour, by the use of either of these two drugs, which have only hitherto furnished fugitive yellows with alumina, the one from French berries being particularly worthless. If this colour may be said to change by being much washed, it is by becoming more red than at first.

Turmeric.

This dye is not capable of being fixed or rendered permanent in cloth either by this, or by any of the other mordants; and although, if the cloth be first dyed by turmeric, and then impregnated with a solution of a salt of uranium, it is changed to red, yet it returns to its original yellow colour with very little washing, indeed by merely holding it in a stream of running water.

Turkey berries, sumach, and valonea, are so similar in their properties to some of the drugs already noticed, that I have not considered it necessary to make any trial with them.

Annotta, when dissolved in an alkaline solution, the usual mode, I believe, of applying it, was not affected by uranium.

It was also tried along with the red dying drugs madder and cochineal, as also with logwood; but as no discovery, likely to be useful to the manufacturer, resulted from my experiments, I shall not trouble you with any remarks upon these dyes, further than by saying, that the colour imparted to it by madder, resembled that given by this drug to alumina, only of a considerable darker shade; and that received from cochineal was of a slate gray colour.

The oxide of uranium made use of by me was obtained from the pitch ore, or native sulphuret of that metal.—*Rep. of Inven.*

The Results of Machinery.

(Concluded from page 412, vol. 7.)

The examples hitherto quoted have exhibited the progress of improvement in works of the hand merely—*manufactures*, properly so called; but it is further shown, that in the operations of the mind there has been the same constant striving after abridgment of labour, attended with the same beneficial results.

"To all of you who read this book it is no difficulty to count a hundred; and most of you know the relation which a hundred bears to a thousand, and a thousand to a million. Many of you are able, also, to read off those numbers, or parts of those numbers, when you see them marked down in figures. There are many uncivilized people in the world who cannot count twenty. They have no idea whatever of numbers, beyond, perhaps as far as the number of their fingers, or their fingers and their toes. How have we obtained this great superiority over these poor savages? Because science has been at work, for many centuries, to diminish the amount of our mental labour, by teaching us the easiest modes of calculation. And how did we learn these modes? We learnt them from our schoolmasters."

* * * *

"When a boy has got hold of what we call the rudiments of learning, he has possessed himself of the most useful tools and machines which exist in the world. He has got the means of doing that with extreme ease, which, without these tools, is done only with extreme labour. He has earned the time which, if rightly employed, will elevate his mind, and therefore improve his condition."

* * * *

"The foot-rule of the carpenter not only gives him the standard of a foot measure, which he could not exactly ascertain by any experience or any mental process; but it is also a scale of the proportions of an inch or several inches, to a foot, and of the parts of an inch to an inch. What a quantity of calculations, and of dividing by compasses does this little instrument save the carpenter; besides ensuring a much greater degree of accuracy in all his operations! The common rules of arithmetic, which almost every boy in England now learns, are parts of a great invention for saving mental labour. The higher branches of mathematics, of which science arithmetic is a portion, are also inventions for saving labour, and for doing what could never be done without these inventions. There are instruments, and very curious ones, for lessening the labour of all arithmetical calculations; and tables—that is, the results of certain calculations, which are of practical use, are constructed for the same purpose. When you buy a joint of meat, you often see the butcher turn to a little book, before he tells you how much a certain number of pounds and ounces amounts to, at a certain price per pound. This book is his "Ready Reckoner," and a very useful book it is to him; for it enables him to despatch his customers in half the time that it would otherwise require, and thus to save himself a great deal of labour, and a great deal of inaccuracy. The inventions for saving mental labour, in calculations of arithmetic, have been carried so far, that Mr. Babbage, a gentleman whose name we have twice before mentioned, has invented a calculating machine, which not only does its work of calculation without the possibility of error, but absolutely arranges printing types of figures, in a frame, so that no error can be produced in copying the calculations, before they are printed. We mention this curious machine, to show how far science may go in diminishing mental labour, and ensuring accuracy."

* * * *

"The effects of saving unprofitable labour are the same in all cases. The use of machinery in aid of *bodily* labour has set that bodily labour to a thousand new employments; and has raised the character of the employments, by transferring the lowest of the drudgery to wheel and pistons. The use of science in the assistance of *mental* labour has conducted that labour to infinitely more numerous fields of exertion; and has elevated all intellectual pursuits, by making their common processes the play of childhood, instead of the toil of manhood.

It can never be too strongly impressed on the public mind—perhaps it is not sufficiently so in the treatise before us—that wherever there is a saving of labour, whether in mental or bodily operations, there is uniformly a progression in improvement. Articles are made not only at less cost, but a great deal better; calculations and deductions not only quicker but more accurately. The cloth produced by machinery is of a more equal and durable texture than that made by hand; and a pin is a more perfect cylinder than any hand could produce of so small a size. The slate and pencil may err, even in the expertest hands; but tables, which have stood the test of ages, never. Could all the labour which the common multiplication table has saved mankind, and all the errors from which it has protected them, only be calculated, the mind could hardly fail to contemplate with amazement, the vast good of which even this very simple, but most ingenious contrivance, has been the source.

The absurdity of the prevailing prejudices against the use of machinery is still further illustrated by an analysis of some of the more recent cases of combination against it. In December last, a band of agricultural labourers, in the neighbourhood of Aylesbury, destroyed all the machinery of many farms, down even to the common drills; but they *could not make up their minds* as to the propriety of destroying a horse-churn, and therefore they passed it over. But—

"Why should the labourers of Aylesbury not destroy the harrows as well as the drills? Why leave a machine which separates the clods of the earth, and break one which puts seed into it? Why deliberate about a horse-churn, when they are resolved against a winnowing machine? The truth is, these poor men perceive, even in the midst of their excesses, the gross deception of the reasons which induced them to commit them. Their motive is a natural; and if lawfully expressed, a proper impatience under a condition which has certainly many hardships, and those hardships in great part produced by the want of profitable labour. But in imputing those hardships to machinery, they are at once embarrassed when they come to draw distinctions between one sort of machine and another. This embarrassment decidedly shows that there are fearful mistakes at the bottom of their furious hostility to machinery."

The gross ignorance in which the agricultural peasantry are so generally sunk, may serve to account for the folly of these Aylesbury men; but there have been other classes of operatives equally foolish, for whom no such apology can be offered. The prejudice against machinery has not been confined to peasants who can neither read nor write, but has been largely shared in by the (comparatively) well-educated and well-paid artizans of our cities and towns—by those even who are most intimately connected with the diffusion of knowledge—who live by books, and are, or ought to be, better acquainted with the wisdom that is in books than any other workmen whatever. Last September the operative printers of London, following the example of their brethren of Paris, came to a series of resolutions deprecating in strong terms the employment of machinery in printing, unless subjected to a heavy tax. The merits of this proceeding were well discussed in a letter, which appeared at the time, ni the "Mechanics' Magazine" for October 9, 1830, and need not therefore be gone into again. From the journeymen printers the mania passed to the journeymen bookbinders of the metropolis, from whom a circular appeared about two months ago, calling upon their employers to give up the use of a machine for beating books.

"Books, before they were bound in leather, used to be beat with large hammers upon a stone, to make them solid. That work is now done in London by a machine. The workman is relieved from the only portion of his employ which was sheer drudgery—from the only portion of his employ which was so laborious that it rendered him unfit for the more delicate operations of bookbinding, which is altogether an art. The greatest blessing ever conferred upon bookbinders, as a body, was the invention of this machine. Why? It has set at liberty a quantity of mere labour without skill, to furnish wages to labourers with skill. The master bookbinders of London and Westminster state, that they cannot find good workmen in sufficient quantities to do the work which the consumer requires. The good workmen and the bad each were employed in the drudgery of beating, which called into action a certain muscular power of the arm and hand, which unfitted them for the delicacy and rapidity of other operations of bookbinding. The good workmen were therefore lessened by the drudgery of the beating-hammer; but the bad workmen, the mere labourers, whose work a very simple machine can do better, feel that they cannot compete with this machine. Why? They were indolent and dissipated, and the work which they neglected is now done without their aid. The great delay in bookbinding was always occasioned by the delay in beating. It was the mere drudgery which the better men paid others to perform; and these mere drudges, by the neglect of their work, kept the higher orders of bookbinders idle. And yet, in spite of their own experience, all the bookbinders try to put down the beating machine, which has a tendency, above all other things, to elevate their trade, and to make that an art which, in one division of it, was a mere labour.

"The objection of the bookbinders to the beating machine offers a remarkable example of the inconsistency of all such objections. The bookbinders have a machine called a plough, for cutting the edges of books, which is, probably, as old as the trade itself. A great deal of labour, and a great deal of material, are saved by this plough. Why do they not require that a book should be cut with a ruler and a pen-knife? They have presses, too, acting with a screw, to make the book solid and flat. A press with an iron screw will do ten times the work of a press with a wooden screw; and one of Bramah's hydraulic presses, which has power enough, if fully exerted, to break a piece of wrought iron three inches thick, will do twenty times the work of the common iron screw press. Nobody insists that the master bookbinder shall use the press of the smallest power—that he may be compelled, at the same time, to use the labour of ten men instead of one. The objection would be too absurd upon the face of it. But a press of any kind is an *old* machine. A machine for beating books is a *new* machine. Working men, and other men, who ought to know better, have attempted to draw distinctions between old machines and new machines. As it is, the inventors of machines generally go before their age; and thus too many of them have either starved or struggled for years with want, because their own generation was not wise enough to value the blessings which science and skill had provided for it. But if the ordinary difficulties of establishing a new invention, however valuable it might prove, were to be increased by the folly which should say, we will have no new machines at all, or at any rate, a machine shall become old before we will use it, there would be an end to invention altogether."

After all, why should we be surprised at journeymen printers and bookbinders entertaining such mistaken notions when every body knows that these notions have their open advocates in all walks of life—even the very highest? Have there not been resolutions of justices as well as of journeymen against machinery? And have not the walls of both houses of parliament resounded with complaints of the manifold evils which the progress of mechanical improvement is bringing on the country? The truth is, that the prejudice we are contending against, pervades all ranks of British society to an extent which it is quite humiliating to think of. It shows that with all our freedom, all our facilities of acquiring knowledge, and all our boasted enlightenment, great numbers of us are still in a state of great darkness—so deplorably blind, as to be blind to the great source of all the blessings we enjoy. Most truly was it remarked by the correspondent, to whose letter we have before alluded, that were such demands as those of the journeymen printers to be listened to, the whole of that "complicated machine of society, which it has taken centuries to construct and put together, would be pulled to pieces in a few months;" and that it is to the refusal of such demands, "England and Europe owe their present glory." The same view of the matter is excellently enforced in the following eloquent passages of the little treatise before us.

"Society must either go forward or backward. There can be no halting place for any long period. * * * If the present state of popular feeling were to prevail and extend—if the brute force which seeks to destroy machinery were not to be put down by the power of the laws, and if the unwise prejudice which desires to depress it could not be conquered by the power of reason—the glory and prosperity of this country would be gone for ever. We should have reached the end of our career of improvement. We should begin a backward race; and it would remain for the inquiring savages of such countries as New Zealand and Otaheite to march forward. The night of the dark ages would return to Europe."

* * * *

"There would be no new capital employed to give facilities to commerce and manufactures, whose prosperity is mainly the result of machinery. There would be no more capital for public works, which employ thousands of workmen in their construction. Would the rail-way from Birmingham to London be proceeded with, in which a capital of three millions sterling is to be employed, if the artisans of Birmingham were to break their machines? There would be an end of the commerce of Birmingham in that case; and then the rail-way would be given up, for the existing canals would have no employment, and there would be no traffic on the roads. The only use of roads would be to enable the starving workmen, (starved by their own folly,) to wander about the country in search of that profitable labour which they had destroyed. They would wander about in vain. The capital would make itself wings and fly away to other countries, where men still acted as reasonable beings. Our capital, our machines, and our best mechanics, would go to France and America. The tyranny of a mob would drive away the wealth and industry of the nation to places where they could be employed in security, just in the same way as the tyranny of a king drove the French silk and cotton weavers to this country a century and a half ago. The effects of all tyranny are the same, whether it be that of one despot or of many despots. Tyranny of any kind destroys our peace and our security. When men are in terror they try to save what they have got, instead of endeavouring to get more. Capital no longer does its work, labour is at an end.

"It is easy to perceive from these facts, which cannot be denied, that if, through the prejudices of some mechanics against machinery, the capital engaged in manufactures should be rendered as insecure as the capital engaged in agriculture, capital would go to other countries where such insecurity did not exist. The insecurity of capital employed in agriculture, and of capital employed in manufactures, would extend to capital employed in commerce; and the want of employment of capital in each of these great branches of human industry would produce a state of misery which it would be fearful to contemplate. We should all be more or less without food, without fuel, without clothes. The land would cease to produce corn, the mines would cease to produce ore, the forges would cease to produce tools, the looms would cease to produce cloth. There would be

> 'No kind of traffic,
> * * * * no name of magistrate;
> Letters should not be known; no use of service,
> Of riches or of poverty; no contracts,
> Successions; bound of land, tilth, vineyard, none;
> No use of metal, corn, or wine, or oil;
> No occupation; all men idle, all,
> And women too.'"

"The poet has well described the state of a community without industry, because without capital. It is the state of savages who bear its hardships, and who are few in number, because they are thinned by those hardships. But let a nation of twenty millions of people, by any act of folly, drive capital away from them, and famine, pestilence, civil war, midnight murder, rapine, and every other dreadful calamity, would follow this unnatural violation of the laws of God and man. The twenty millions would soon be reduced to one million; the country would fall back a thousand years. We should all be idle, but our idleness would not feed or clothe us; we might all desire to labour but there would be no accumulation to give us profitable labour. We should all be prodigals who had spent our substance, and there would be no forgiving parent's home where our misery might be pitied and relieved when it is past endurance. The friend whom we had driven from us would never return. We could not go to the capital; the capital would not come back to us. The land would be depopulated, and rendered barren; and then the few that remained would have slowly to emerge from poverty and barbarism, by going back to the arts which the world has been laboriously acquiring for thousands of years."

Are there, then, really no evils attending the introduction of improvements in machinery? It is admitted that "every change produced by the substitution of a perfect machine instead of an imperfect one, of a cheap machine instead of a dear one," is a change which "more or less affects the interests of capitalists as well as of workmen," and "has more or less in it of the positive suffering and heart-wearing uncertainty which belongs to all change:" but it is on the other hand, very justly observed, that any injury such improvements may cause to individuals is only partial and temporary, while the benefits flowing from them are universal and permanent. "Every improvement brings healing upon its wings, even to those for whom it is a momentary evil—if it displace their labour or their capital for a season, it gives new springs to the general industry, and calls forth all labour and all capital to higher and more successful exertions." The evils, too, attending that state of change which necessarily follows a state of improvement, are susceptible of great mitigation; a wise government may do much towards that end—individual foresight and exertion still more. What the British government might accomplish in aid of British industry, the author of the treatise before us, professes not to discuss; but he has devoted a concluding chapter to showing the working people "the means which they possess in themselves" to bear up against every change that can befall them. The first thing, he says, they should do, is to get knowledge—*such* knowledge, that when deprived of one employment they may easily turn to another; the next, to get capital, that is, to lay by some money, on which they may fall back for support when they cannot dispose of their labour to advantage. No one can find fault with these precepts; so far as they go they are excellent; but who can say they go far enough? Are the means of getting knowledge and saving money so certainly within the reach of every working man in this country, that it can be fairly said to be his own fault if he is not possessed of a competent share of both? May not the march of honest industry be so impeded by artificial obstructions—by grievous imposts and annoyances at every step—that even the best-disposed and the most hard-striving shall have good reasons to despair of ever getting above the pressure of their daily necessities? And if such artificial obstructions exist, ought it not to be one of the first concerns of the working man to have them removed? The writer of this treatise says, in the name of the society of which he is the organ, "it is not *for us* to point out what may be expected from the collective exertions of society;" *we* shall not attempt to discuss that part of the question which belongs to the duty of a government;" "*our* business is with the people themselves." But why the "*not?*" We must confess we do not comprehend the distinction here attempted to be drawn. What are the people without rulers, or rulers without a people? And though your business be only with "the people themselves," can you do better than tell the people how they may get rid of any shackles which a succession of foolish or iniquitous rulers may have imposed on them? It might not, we are aware, look well, or work conveniently, to see a society with a Lord Chancellor for its chairman, and a Chancellor of Exchequer, and the King's Attorney-General, on its committee of direction, urging the working classes to *agitate their grievances*—to besiege the houses of parliament and the palace of the King with supplications for the repeal of this or that oppressive burden—the repeal of the coal tax for example, which bears the hardest perhaps of all our public burdens on manufacturing industry,* or the removal of the fees on patents, which exacted for the enrichment of a few officers of the crown, (the Lord Chancellor and Attorney-General themselves among the number,) form one of the greatest obstacles to that advancement in mechanical improvement which it is the professed object of this treatise to promote. But though office, and the fees of office, may be very good reasons why the Lord Chancellor's Society for the Diffusion of Useful Knowledge should *now* be silent on such topics, they furnish no reason for the people being silent upon them. They only show how awkward a thing it is for *Ministers of the Crown* to write *books for the people.* Although professing to do "the business" of the people, they are obliged, from considerations personal to themselves, to leave one-half of that business undone. We think that no one can doubt that if the chairman of the Society for the diffusion of Useful Knowledge had been still plain Henry Brougham, he would have held it to be his very first "business with the people" to point out what their rulers ought to do for them as well as what they ought to do for themselves, and to exhort them to meet and petition, and remonstrate incessantly, till every unjust impost and vexatious regulation was abolished. But plain Henry Brougham is now Lord Brougham, and a leading member of the Cabinet as well as Chairman of the Useful Knowledge Society; and what it may be proper for him in the one capacity to say to the people, it is not expedient for him to say in the other; and so, to get over the difficulty, the whole of "that part of the question which belongs to the duty of a government" is left untouched! Not *altogether* untouched, however; for though the treatise before us says nothing about what the people should demand from their rulers, it is not wanting in significant hints of what the rulers *will do* if the people should think of taking the redress of their grievances into their own hands. At page 25 we meet with these words—"if the laws were passive, *which they will not be*, the most ignorant of the labourers themselves would see," &c. The portentous "*which they will not be*," is given in the original, as here, in italics, to impress the fact more forcibly on the mind of the reader, that the reader is speaking as with the voice of authority. The "schoolmaster" no longer chooses to discourse to you of popular grievances, but he shakes his birch as usual. Surely this little display of power might well have been spared. If it be true, (as who can doubt?) that nothing so disposes men to submit to hardships as a knowledge of the causes to which they are owing, and a conviction that they are in a course of being speedily remedied, so, on the other hand, it is very certain that if you tell a man that every thing depends on himself, when both you and he know well that much depends on others, and if you further make use of the terrors of the law to enforce this delusive half view of the case, nothing is more likely to make the counselled turn a deaf ear to those who counsel him. "Get knowledge and get money"—this is the sovereign panacea of the Useful Knowledge Society; but experience tells us there are many difficulties and obstructions in the way of getting knowledge and money, which, originating with the government, ought by the government to be first removed. It is altogether fallacious to say that the remedy "rests with the people themselves"—fallacious at least, in the sense in which these words are used by the Useful Knowledge Society: for, to reconcile them to truth, we must include in what, "rests with the people themselves" the right and the duty of petitioning for a redress of grievances; which right and duty are passed over by this society as of no account in relation to the question of want of employment. The society recommend, that when a workman is thrown idle by machinery, he should "strike into some new line of labour." But what, if in every new line which he thinks open to him he should meet with a lion in the path, in the shape of law of settlement, corporation privilege, government license, or something else equally oppressive and ridiculous? The society evidently blink a most important branch of the inquiry, when they do not show the workman how he may be freed from every restraint on his industry, and what he can himself do to work out his freedom. And they blink it—not because it is unfit the workman should be told this—but because it is unfit for a society, whose leading members have become Ministers of State, to play any longer the part of political agitators. We said, at the first establishment of this society, that it was not likely to work well for any great length of time; and that it owed its first chances of success mainly to the circumstance of its promoters being, for the time, in (what is called) opposition to the government—all for the people, and the people's rights and interests. Verily, our anticipations are beginning to be realized.

---

* See "Observations on the Duty of Seaborne Coal, and on the Peculiar Duties and Charges on Coal in the Port of London," an excellent pamphlet, just published by Messrs. Longman & Co. It is perfectly unanswerable.

Nevertheless, we acknowledge, most unreservedly, that, for the present treatise, so far as it goes, the British public have every reason to feel grateful; we must confess, too, that the defect which we have pointed out is a consequence of personal circumstances, which is more to be regretted than severely censured. Some other pen, less fettered by official considerations, will probably supply that branch of the inquiry which this treatise has left untouched; and though we have no longer the pleasure of seeing a Brougham and a Denman heading the popular array against the abuses of our political system, it is assuredly a great source of consolation, that they have been elevated, by their eminent talents and virtues, to offices which give them more power than ever, to carry into effect those reforms which it has been the great business of their lives to advocate and enforce. [*Mechanics' Magazine.*

Biscuit Baking by Steam.

Until within the last few years, all the flour and biscuit consumed in the navy was furnished by private contract. The most flagrant impositions and frauds were but too generally the consequence of this mode of supply, in defiance of all the vigilance of the heads of departments. The flour and biscuit were stipulated to be of the second-best quality; but instead of this, the former was generally mouldy, damaged, or of a very inferior description to that bargained for; while the latter was usually compounded of bad flour, bean meal, old worm-eaten biscuits ground down, and various other cheap or unwholesome materials. To obviate these frauds, government, a few years ago, erected steam-mills at Deptford and Portsmouth, for the purpose of grinding flour for the navy; and a very superior and cheaper article being the result, it was determined, in addition to grinding the flour, to attempt also the manufacture of biscuit from it, at these establishments. The impossibility of accommodating and effectually superintending the multitude of bakers required to knead the dough in the usual way, by hand, so as to effect the supplying of the whole navy, would have rendered this praiseworthy effort, in a great measure, abortive, had not the ingenuity of Mr. Grant, storekeeper at Portsmouth, obviated the difficulty. By the attachment of a few simple pieces of machinery to the engine driving the flour-mill, the dough is now worked, rolled out, and stamped into biscuits, with an expedition inconceivable, and with a saving of two-thirds of the number of bakers required to perform these processes by hand. The flour and water are first put into a trough, through which passes an iron spindle, armed with eighteen knives, in two rows, *i. e.* nine in each row, on opposite sides of the spindle. A strap connected with the engine turns the spindle round; and by means of the revolving knives, the flour and water are in a few minutes worked into dough fit for being stamped into biscuits. The dough is now taken piecemeal from the trough, and shaped by hand into longish rolls, upon two moveable baking-boards, supported by small iron pillars, having castor-wheels at top: these pillars are in three rows, extending from the trough to the two rolling machines; and along the castors upon their tops the baking-boards are pushed, by hand, towards the rollers, under which the dough is rolled out into thin cakes, by their backward and forward swinging motion. The baking-boards are now pushed out, by hand, from under the rollers, and slided along three other rows of pillars connecting the two rollers with the two cutting machines, each containing forty-two hexagonal dies, under which they are momentarily placed, and eighty-four biscuits thus cut out by a single stamp of the two machines. The kneading, rolling, and stamping portions of the machinery, being all separate, can consequently be put in motion or at rest at the will of the baker. By the machinery at Portsmouth, under Mr. Grant's superintendence, 160,000 pounds of biscuit can be manufactured in twenty-four hours—constituting a day's ration for the crews of twenty sail of the line; and with eight or ten such pieces of machinery, biscuit rations may be daily manufactured for 160,000 men, being the greatest number of seamen and marines employed during the hottest period of the war. About 5,000*l.* has been expended in erecting the baking apparatus at Portsmouth; a considerable portion of which expense was naturally occasioned by the alterations and improvements consequent on the erection of a new piece of machinery; but even this sum will be refunded to government during the first year of its employment, by the saving made. This saving of expense, however, is not the only recommendation—the biscuit being free from flutiness, and in every respect more palatable than that baked by hand, in consequence of being more thoroughly kneaded. From the rapidity of the manufacture, also, no more biscuit need now be baked than is required for immediate use, from the supply by this process being as certain as it is rapid; so that our seamen will in future have always fresh-baked and wholesome biscuit served out to them, even on foreign stations, instead of the stale, mouldy, worm-eaten, and unpalatable contract trash generally furnished during the war, which had often been baked for years before issued. It is only those who have been doomed to the penance of the contract flour and biscuit that can duly appreciate the great boon conferred upon our brave seamen by this project of the government; the above articles now supplied to the navy being very superior in quality to those furnished the merchant service—such, indeed, as are fitting for any gentleman's table; and all this at a much lower cost than the former contract supplies.

The first bags of biscuit of this manufacture having, in addition to the usual King's mark of the broad arrow, the word "machinery" stamped in capital characters upon them, this novel and imposing symbol at once struck the eyes of the superstitious tars as something very mysterious, and many were the solutions attempted of the enigma; until one, more deeply read than the rest, dropping upon one knee, and rolling his quid round and round in his mouth, while tracing with his finger and spelling and re-spelling over and over the ominous word, at length started up from his reverie, and exclaimed with an oath, "Why, it aan't only the name of the squab of a baker—Mac Henry, Mac Henry, that's all that's in it!" and the "machinery biscuit" is now, consequently, known among the tars by the cognomen of "Mac Henry's biscuit." P. C.

[*Literary Gazette.*

The Silver Isis Medal and Five Pounds were presented to Mr. T. Lowthorp, *25 Crescent street, Euston Square, for his Emery Cloth; samples of which have been placed in the Society's Repository.*

There is an immense consumption of sand paper and of emery paper, both in private families for cleaning furniture and utensils of iron and steal, and still greater in manufactories of hardware of all descriptions. But paper is so brittle that it will not hold together after having been used a little while, and, unfortunately, this happens just when its quality as a polisher is the best, from the coarser grains of sand or emery having been rubbed off.

By substituting the cheapest kind of calico for paper, the candidate has produced an article, the durability and utility of which far exceed the additional cost required by the substitution of cloth for paper.

The sand, pounded glass, and emery, are to be sorted by washing over in the usual way, and then are to be dried for use.

The calico best suited for this purpose should be thirty-two inches wide, of a strong even thread, but not too coarse, and which has been as little dressed as possible. It is to be put into stretching frames two yards long, and, after being wetted with warm size, is to be stretched to a width of thirty-six inches. The size employed for this purpose is composed of 2 lbs. of good glue, dissolved in six quarts of warm water, and then mixed with two quarts of water that has previously been boiled with half an ounce of alum; and six ounces of good wheaten flour. The mixture is to be put over the fire in any convenient vessel, and, when it begins to bubble, is to be poured out into a pan for use.

On the dry calico, still in the frame and stiff with the coating of size, is to be laid on another coat of a stronger size, made by dissolving 4 lbs. of glue in three quarts of warm water, and adding one pint of the first size, together with an ounce of gum arabic and an ounce of gum tragacanth.

While this strong size is yet wet, the emery, sand, or glass-powder, is to be sifted on as evenly as possible, and the calico is again set to dry, and is afterwards brushed, to remove the loose particles: a second coating of strong size is then to be laid on, and is to be covered with another layer of sifted emery, &c. It is then again to be dried and brushed, and is now ready to be removed from the frame, and cut up into sheets for sale or for use.—[*Register of Arts.*

On the Illumination of Light-Houses. By Lieut. THOMAS DRUMMOND, *of the Royal Engineers.*

[From Abstract of Meeting of Royal Society.]

THE author, after briefly describing the different methods at present employed for illuminating light-houses, proceeds to detail what he considers an improvement upon those now in use. This consists in substituting for the Argand burners a small ball of lime, ignited by the combustion of oxygen and hydrogen.

From this small ball, only three-eighths of an inch in diameter, so brilliant a light is emitted, that it equals in quantity about thirteen Argand lamps, or 120 wax candles; while, in intensity or intrinsic brightness, it cannot be less than 260 times that of an Argand lamp. These remarkable results are deduced from a series of experiments made lately at the Trinity-house; and, having been repeated with every precaution, and by different individuals, there seems no reason to doubt their accuracy. In the best of our revolving lights, such as that of Beachy Head, there are no less than thirty reflectors, ten on each side. If, then, a single reflector, illuminated by a lime-ball, be substituted for each of these ten, the effect of the three would be twenty-six times greater than that of the thirty. On account of the smaller divergence of the former it would be necessary to double their number, placing them in a hexagon instead of a triangle. In this case the expense is estimated at nearly the same. This method was tried lately at Purfleet in a temporary light-house, erected for the purpose of experiments by the corporation of the Trinity-house, and its superiority over all the other lights with which it was contrasted was fully ascertained and acknowledged.

On the evening of the 25th of May, when there was no moon-light, and the night dark, with occasional showers, the appearance of the light viewed from Blackwall, a distance of ten miles, was described as being very splendid. Distinct shadows were discernible, even on a dark brick wall, though no trace of such shadows could be perceived when the other lights, consisting of seven reflectors with Argand lamps, and the French lens, were directed on the same spot. Another striking and beautiful effect peculiar to this light was discernible when the reflector was turned, so as to be itself invisible to the spectator. A long stream of rays was seen issuing from the spot where the light was known to be placed, and illuminating the horizon to a great distance. As the reflector revolved, this immense luminous cone swept the horizon, and indicated the approach of the light long before it could itself be seen from the position of the reflector.

These singular effects, must not, however, be understood as constant accompaniments of this light, for on a moon-light night, or when the weather is very hazy, they cease to appear.—[*Jour. of Roy. Ins.*

Photometer, or Instrument for measuring the relative Intensity of two Pencils of Light. *By* Mr. W. RITCHIE, A. M. F. R. S.

[From the Transactions of the Society of Arts.]

A PHOTOMETER is an instrument for the purpose of comparing the relative intensity of light given out by different bodies in a state of combustion or incandescence. There are two modes of measuring light, either by the actual comparison of the lights themselves, or of the shadows produced by intercepting part of the lights. The former was employed by Bouguer, to whom is owing the construction of the first photometer, and the latter by Count Rumford.

The general mode of operating is the same in both; that is, the two lights or shadows to be compared are brought to an apparent equality on a particular spot, and the relative intensity is obtained by measuring the distance from this spot to each of the luminous objects, and then squaring the distance so found. Thus, if the lights or shadows of two lamps are equal, one being at the distance of two, and the other of three feet, the illuminating power of the former will be expressed by four, and of the latter by nine.

In practice, it is found more convenient to have the lights stationary, and to move the photometer, than the reverse; and it is on this latter principle that Mr. Ritchie's photometer is constructed and employed. It consists of two mirrors, placed at right angles to each other within a wooden box open at both ends, in order to admit the rays from the two luminous objects to be compared: these rays are reflected upwards to a slit in the top of the box, which slit is covered with semi-transparent white paper. A wooden trunk, widening upwards, is raised upon this slit, for the purpose of enabling the observer to compare the two portions of reflected light without disturbance from any other rays. The two lights to be compared, and the two mirrors, being brought into one straight line, the photometer is to be moved along this line till the reflected rays from both objects appear to be precisely equal: the relative distance of each from the photometer being then measured or read off, these numbers squared give the relative intensity of each light.—[*Rep. of Pat. Inven.*

CLEMENT'S *Experiment—Easy Mode of Repeating it.*

THE very curious, and apparently paradoxical experiment, first described by Clement, in which air, gas, or steam, issuing with force from a hole in a flat surface, did not blow away a platter or other flat and extended body, but rather caused its adhesion, has been repeated since in a great variety of forms. M. Hachette contrived a simple little apparatus, by which every one was put in possession of the power of witnessing the effect: and such facilities are valuable, because they rapidly extend the knowledge of curious effects, and cause them to be still more extensively pursued and investigated. The experiment may be still further simplified in the following manner. When the fingers of the open hand are retained as close to each other as they can be, still there are certain slit-like intervals between them extending from joint to joint. Let the hand be held horizontally with the palm downwards, apply the lips to the interval between the second and third fingers nearest to their roots, and then blowing with force, a strong jet of air will of course issue from the aperture at the under side of the hand. Now, put a piece of paper or a card three or four inches square against that aperture, and again blow; it will be found that the paper will neither be blown away, nor fall by its own weight, but will be pressed upwards against the hand and the issuing current of air, so long as that current continues. The moment it ceases, the paper will fall away by its own gravity, in obedience to the ordinarily active laws of nature.—M. F.

[*Jour. of the Roy. Institu. Feb.* 1830.

On the Discharge of a Jet of Water under Water. R. W. Fox, *Esq.*[*]

The following letter is addressed to the Editors of the *Philosophical Magazine.*[†]

"I am not aware, that it has been before noticed, that a jet of water discharges the same quantity, in water, as in air, in a given time, without reference to the depth or the motion of the water, at least within certain limits. Thus when the experiment was tried with a head of water six feet high, the same orifice discharged equal quantities in equal times, in air, in still water, and in a rapid stream, moving at the rate of about six feet in a second; the jet having in one case been turned with the current, and in another against it: and when, by lengthening the tube, the aperture was submerged to the depth of fifteen feet, the effect was the same as at the surface, under the pressure of an equal column above it. These results have been obtained by my brother Alfred Fox and myself, and you may perhaps think them deserving a place in your magazine, if they should appear to you to be new.

"We sometimes coloured the water, when the jet appeared to pass unbroken to a considerable distance under the water."—*Ib.*

On Preventing the Discharge of a Bullet from a Gun by the Finger.

At the sitting of the Helvetic Society of Natural Sciences of the 28th July last, a letter was read from Dr. Flachin of Yverdun, relative to an experiment before mentioned to the society, in which the ball was prevented from leaving the bottom of a musket when the gunpowder was fired, simply by putting the ramrod upon the ball, and the end of the finger upon the ramrod. He supposes the effect may be explained by the circumstance, that near the charge the ball has a very small velocity compared to that impressed upon it by the expansive force of the gases from the fired gunpowder, when exerted during the whole of the time in which it is passing along the barrel. It is well known that the effect thus accumulated is the reason why long pieces carry further than short ones, and why the breath of a man, which cannot exert a pressure of more than a quarter of an atmosphere; may, by means of a tube, throw a ball to the distance of sixty steps. The experiment above requires great care, especially as to the strength of the piece, which is very liable to burst in the performance of the experiment.*—[*Ib.*

---

[*] By a reference to the 2nd volume of this Journal, page 61, it will appear that experiments on this very subject, with a similar result, were made by James P. Espy, of Philadelphia, in the year 1828. These are his words: "I have lately ascertained, by some experiments in hydraulics, (which I shall publish before long,) that as much water runs out in a given time through a hole in the side of a vessel containing water under a given head, when the egress is made below the surface of water, as when it is made in the open air."

[†] Vol. viii. p. 342.

New Lamp.

Among the useful applications of scientific knowledge to our improvement in domestic articles, we have this week to mention a lamp of a new construction, and on a new principle, which was exhibited on Friday at the Royal Institution, and one of which is now burning on our table before us, affording us the light by which we describe its brilliancy and good qualities. It is the invention of Mr. Parker; and certainly for illumination is equal to oil gas, which it surpasses in steadiness and equability. The essence of the invention is, that a column of air keeps the oil always at the proper height of the wick, so that the flame is continually of the same splendour, without flickering. Yet the machinery is most simple, and the form agreeable. There are no rims to cause shadows; and altogether we do not know when we have been more pleased with a thing of the kind for daily use or ornament. The new lamp is truly a new light.—[*Lit. Gaz.*

Extraction of Potash from certain Minerals.

This alkali, so important in the arts, may, it is stated, be extracted from minerals containing it, by a very ample process. This consists in merely calcining them with lime, and then leaving them for some time in contact with water, which is afterwards filtered and evaporated. M. Fuchs, as quoted in the *Ann. de l'Industrie*, states, that he has in this manner obtained from 19 to 20 per cent. of potash from felspar, and from 15 to 16 per cent from mica.—*Ib.*

On the Machinery for Making Paper.

At a meeting of the Royal Institution, in London, Mr. Cowper read a paper on the recent improvements in paper making.

These observations were intended as an appendix to a lecture on the same subject, delivered by Mr. Millington in this Institution two or three years ago. Mr. Cowper described the mode of making paper by the machines of Hard and Fourdrinier, for the sake of those of his auditors who were not present at the former lecture. Next, the beautiful machine invented by Mr. Dickenson was illustrated by drawings and experiments. This machine differs considerably from Fourdrinier's: in the latter, the pulp flows upon a horizontal web of wire, about thirty feet in length, stretched on rollers, upon which it revolves; the water from the pulp flows through the web, and leaves the paper on its surface; and as the water drains from the pulp merely by its own weight, it requires about 11 feet in length of wire-web, moving at the rate of 22 feet per minute, or, in other words, half-minute time, to allow the pulp to become sufficiently set before it can be taken off the wire. In Mr. Dickenson's machine, a perforated brass cylinder, about 20 inches in diameter, covered with wire-web, and nearly immersed in the pulp, is substituted for the endless web in Fourdrinier's. The idea is very ingenious. The cylinder is turned truly inside and out,—it is perforated all over by holes and grooves, so disposed that when covered first with a layer of plain wires, and afterwards with the wire-web, there is no part of the wire-web which does not communicate with the interior of the cylinder. The ends of this are closed, and it revolves on a hollow spindle or pipe, which has two or three small branch pipes, bent downward within, but not touching the cylinder: these pipes, from their action, may be called siphons. An air-pipe enters the hollow spindle at one side of the cylinder, and is bent towards the interior upper surface, where it is united to a sort of trough, the edges of which apply themselves closely to the interior, by means of packing, *i. e.* the interposition of any elastic substance. A vacuum is constantly produced in this trough by the air pump: the trough extends 8 or 10 inches along the circumference of the cylinder, all of which part is above the surface of the pulp, in which the rest of the cylinder is immersed. As the cylinder revolves, the water flows through the wire-web into the interior, whence it issues by the siphons through the hollow spindle. The current of water flowing through the wire draws the floating fibres against the cylinder, and the paper continues forming, till, in the course of its revolution, it rises over the vacuum trough. Here the pressure of the atmosphere comes into action, and the remaining water is instantly forced through the wire-web, and the sheet taken up by a blanketed roller. The paper is thus made in the space of a few inches, the machine moving at the rate of 48 feet per minute. Mr. Cowper exhibited a working model of the machine invented by him for preventing the loss, by what, we believe is technically called shavings; a loss varying from one-sixth to one-twelfth of the whole paper manufactured. The model was furnished with a reel of tissue paper, about 200 feet long: the longitudinal cutting is effected by circular knives, and the transverse cutting by a serrated knife, which divides the paper easily, accurately, and with a sufficiently small edge. A drawing was also exhibited, to illustrate Mr. Ibbotson's new strainer for preventing the knobs which are sometimes found in paper. Mr. Cowper concluded by noticing the gratifying results of the improvement in paper making and printing machines; observing that the Bible Society expended between 50,000*l.* and 60,000*l.* annually on paper and printing; the Tract Society also, he stated, frequently printed upwards of 400,000 of a single tract; other societies for the diffusion of knowledge, whose names he mentioned, printed of each number of a series as many as 20,000; and of the new editions of Sir Walter Scott's Tales about 1000 volumes were printed in a day. [*Ib.*

---

* Bib. Univ. 1830, p. 447.

To our Cotemporaries.

We must remind certain of our cotemporaries across the water, that courtesy requires the acknowledgment of the source whence articles are derived, particularly when they are of considerable length and value; we trust these general remarks may suffice.

Com. on Pub.

Meteorological Observations for June, 1831.

Moon.	Days.	Therm.		Barometer.		Dew point	Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2, P.M.		Direction.	Force.		
				Inches	Inches.				Inches.	
	1	71°	92°	30.00	29.94	60	West.	Moderate.		Hazy morn.—clear & dry.
☾	2	74	92	29.95	.94	62	West.	do.		Clear day.
	3	76	87	.84	.80	64	West.	Breeze.		Cloudy day.
	4	76	83	.74	.74	64	West.	do.		Cloudy day.
	5	72	77	.65	.70	62¼	S. S.	Blustering.	.47	Rain-cl'dy.-rain in night.
	6	61	82	.83	.88	57	W. W.	Moderate.	.10	Clear day.
⊗	7	65	86	.90	.90	59½	NW. E.	do.		Clear day.
	8	65	82	.90	.90	52	NW. NE.	do.		Clear day.
	9	60	81	.94	30.00	60	E. S.	do.		Fog—clear.
	10	67	85	30.04	.04	64	SW. W.	do.		Fog—clear.
	11	68	86	30.00	29.95	67	W. W.	Breeze.		Fog—clear.
	12	68	86	29.80	.83	64¼	W. W.	do.		Clear day.
	13	71	84	.80	.85	66	SW. S.	do.		Cloudy—clear.
	14	70	81	.85	.85	68	SE. S.	do.	2.22	Cl'dy—cl'r—thun. shw'r.
	15	66	82	.90	.90	65½	W. W.	do.	.12	Cl'dy-shw'r. [rain night.
☽	16	64	80	.90	.86	68	W. SE.	Moderate.	.2	Cloudy—slight shower.
	17	67	84	.86	.86	67	NE. W.	do.		Fog—Flying clouds.
	18	68	87	.80	.84	74	W. W.	do.	.2	Fog—clear—shower.
	19	70	84	.84	.84	72	W. W.	do.		Cloudy day.
	20	71	84	.90	.90	68	W. W.	do.	.2	Clear—cloudy—rain.
	21	72	84	.80	.80	70	SE. W.	do.		Cloudy day.
	22	69	82	.80	.90	55	W. W.	do.		Clear—flying clouds.
	23	66	68	.85	.85	58	NE. NE.	do.	.65	Rain.
○	24	53	70	30.10	30.15	42	W. N.	do.		Clear day.
	25	53	72	.10	.00	48	W. W.	do.		Clear day.
	26	60	77	.00	.05	57	W. W.	do.		Cloudy—clear.
	27	64	77	.10	.05	61	W. SSE.	do.	.1	Cloudy—rain.
	28	70	75	29.90	.90	68	SW. SW.	do.	.6	Flying clouds—rain.
	29	69	80	.70	.70	62	SSE. W.	do.	1.80	Cloudy—flying clouds.
	30	65	80	.80	.90	62	W. SE.	do.		Clear day.
	Mean	67.03	81.67	29.88	29.89	62.3			5.49	In. of rain in the month.

		Thermometer.		Barometer.	
Maximum height during the month,		92.	on 1st and 2nd.	30.15	on 24th.
Minimum	do. . . .	52.	on 24th and 25th.	29.65	
Mean	do. . . .	74.35	. . .	29.865	

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

AUGUST, 1831.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

[Continued from page 154, vol. vii.]

Having given a general description of the apparatus used in the experiments, the Committee proceed to state the methods employed in estimating the resistance arising from friction.

Experimenters have differed in the results of their investigations of the laws of friction. It results from the experiments of Coulomb, that the friction at the axle of a wheel, or of a roller, varies in the direct ratio of the pressure upon the axle, except in extreme cases. The late experiments of Mr. Rennie* indicate that when unguents are used, the ratio of friction to pressure is not the same for different pressures, the variation depending upon the nature of the unguent and the amount of pressure applied.

The Committee deemed it necessary, therefore, to determine with the apparatus to be used in their experiments, and under the probable loads to which it would be subjected, the relation between the friction and weight. It will be seen that this labour was much abridged by the fact that the experiments showed the ratio of friction to pressure to be constant, within the limits required by the investigations.

The experiments of Rennie have satisfactorily established that the friction of an axle remains the same, in proportion to the weight, under different velocities.

---

* Transactions of Royal Society of London, Part I. 1829, pp. 163 and 164; or Journal of Franklin Institute, Vol. V. No. 2.

The frictions to be estimated by the committee, were those at the axis of the water wheel, and at the axis of the roller, or drum, above the wheel.

To ascertain the amount of friction at the axis of the wheel, a cord was wound about the barreling of the shaft; to this cord was attached a weight varied until it just maintained a velocity of six feet per second in the periphery of the wheel: the weight, thus found, gave the friction upon the gudgeons, when pressed by the weight of the wheel together with the weight representing the friction. The pressure upon the gudgeons being increased, by attaching masses of lead to the wheel at equal distances from, and on opposite sides of, the axis, the friction was found in the cases tried, viz. those within the probable limits of the weights to be borne in the experiments, to be proportional to the weight sustained by the gudgeons of the wheel. The proportion of friction to weight was found to be one and a half per cent.

The friction at the axis of the drum was ascertained by passing a cord over it; to the ends of this cord weights were attached, and the additional weight necessary to cause either extremity to descend with a uniform velocity, gave the amount of friction. By varying the weights at each end of the cord, it was found that in this case, as in that of the wheel, the friction was proportional to the weight borne by the gudgeons, and that the proportion of friction to the weight was one and a half per cent. This latter circumstance tends, as well as the former, to simplify the calculations relating to friction. The weights having been raised by the wheel through the intervention of a chain passing over a drum above, it is evident that the axis of the wheel was drawn upwards with a force due to the tension of the chain between the axis and the drum, that is, to the weights attached to the chain, thus diminishing the pressure upon the axis of the wheel, and lessening, in consequence, the amount of friction; but this tension increased the pressure upon the axis of the drum, and since the friction at that axis, by a given weight, was the same as that at the axis of the wheel, these two opposite effects balanced each other, and there remained the friction due to the weight applied to the chain.

As reference is necessarily made, in the calculations which follow, to the centres of gravity of the loaded parts of the wheel, it may not be amiss to state the manner in which these points were determined. The general remarks apply to the several wheels used, but the details refer to the largest wheel.

The water was supposed to be distributed uniformly over the loaded part of the wheel, a supposition very nearly accurate when the buckets are numerous and the wheel works within a close breast. A section of the wheel perpendicular to the axis, and midway between the rims, being taken, the weight of the water was supposed to be concentrated in that part of the periphery of a circle, a mean between the circles containing the interior and exterior edges of the buckets, which corresponded to the loaded part of the wheel. In Fig.

I, Plate V, *a*, *b*, *g*, represents the semi-circumference of this circle, a mean between the semi-circumferences A, D, F, I, and K, L, M, of Fig. I, Plate IV, the radius being 9 feet 9 inches in the case figured, viz. that of the large wheel. To find the arcs corresponding to the loaded portions of the wheel, this circle was described upon a large scale; the several points answering to those at which the water, admitted to the wheel through apertures Nos. 1, 2, &c. (Fig. I, Plate IV,) first struck the wheel, were laid down, as at *a*, *b*, *c*, *d*, *e*, and *f*, (Fig. I, Plate V,) the lowest point of the wheel, *g*, being taken as the point at which the water was discharged, the arcs sought were *acg*, *bcg*, *cdg*, *deg*, *efg*, and *fhg*. The centre of gravity of each of these arcs, was then found by the usual method. The diagram shows the chords, *ag*, *bg*, *cg*, &c. from which the lengths of the arcs were obtained, the lines bisecting these chords, and upon which the centres of gravity of the arcs are to be found, *ci*, *ck*, *cl*, &c., and upon these lines the points corresponding to the centres of gravity, viz. G, G′, G″, G‴, G$^{\text{iv}}$, G$^{\text{v}}$. By drawing lines parallel to *ag*, from the points thus found, the distances from the axis of the wheel, obtained by calculation, are shown upon the scale traced in the figure.

We shall now give the calculations of the amounts of resistance from friction, in the wheel and drum, under the various loads to which they were subjected in the course of the experiments.

First. Constant *inactive* weight borne by the gudgeons of the wheel and drum during the experiments.

Weight of the water wheel,	2200 lbs.	
The whole weight of the chain was 318 lbs.; of this an average weight of 34 lbs. (20 feet of the chain,) rested upon the ground during each experiment, and that part of the chain between the barrel of the shaft and the ground (20 lbs.) acted to resist the motion of the wheel: deducting, therefore, 54 lbs. from the weight of the chain, we have for the constant *inactive* weight upon the gudgeons of the wheel and drum, derived from the chain,	264 „	
Weight of the drum,	200 „	
Total constant inactive weight,	2664 lbs.	
The friction upon this, at one and a half per cent, is		39.96 lbs.

Second. Constant weight *resisting* the motion of the wheel, which was borne by the gudgeons of the wheel and drum.

That part of the chain which was between the barrel of the shaft of the wheel and the ground,	20 lbs.
The iron basket used to contain the weight,	126 „
Three bars of lead, weighing together	111 „
Total constant resisting weight,	257 lbs.

Friction due to this weight at one and a half per cent, - - - -		3.85 lbs.
The total friction derived from the *constant weight*, is, therefore, - -		43.81 lbs.

The amount of friction due to the constant weight having been thus found, we proceed to the numbers which varied with the weights added in the experiments, and with the points of admission of water to the wheel.

Chute No. 1. (Fig. I, Plate IV.)

The centre of gravity of the water in the buckets of the wheel when supplied by this aperture, was 6.207 feet from the axis, and the barrel about which the chain was wound was 1 foot from the same axis; hence to raise 257 lbs. the constant resisting weight, and overcome a friction of 43.81 lbs. the constant friction just found, required a weight of water of - - - -	48.46 lbs.	
The friction due to this weight, is -		0.73 lb.
Constant friction derived above, - -		43.81 "
Whole amount of friction overcome in raising the constant weight of 257 lbs. -		44.54 lbs.

To find the additional friction due to each of the bars of lead which were used as weights, we have,

Weight of the bar, - -	103.00 lbs.	
To balance this weight and the friction due to it, (103 lbs. + 1.54 lb.) or 104.54 lbs. required, at 6.207 ft. from the axis, a weight of water of - - -	16.84 "	
Total, - - -	119.84 lbs.	
Friction for each bar of lead, being that upon the weight just found at one and a half per cent. - - - -		1.80 lbs.

Chute No. 2. (Fig. I, Plate IV.)

In this case the centre of gravity of the water in the buckets, was 7.01 feet from the axis, to raise 257 lbs. and overcome the friction of 43.81 lbs. required, - - -	42.91 lbs.	
Friction due to this, - -		0.64 lb.
Constant friction as above, - -		43.81 "
Total friction due to constant weights, -		44.45 lbs.

For each additional bar of lead,—		
Weight of the lead,	103.00 lbs.	
To balance this weight and the friction due to it,	14.91 „	
Total,	117.91 lbs.	
Friction for each bar of lead,		1.77 lbs.

CHUTE No. 3. (Fig. I, Plate IV.)

The centre of gravity of the load was in this case 6.58 feet from the axis: to raise 257 lbs. and overcome a friction of 43.81 lbs. required,	44.72 lbs.	
Friction due to this,		0.68 lb.
Add as before,		43.81 „
Total friction due to constant weight,		44.49 lbs.
For each bar of lead which was added,—		
Weight of the lead,	103.00 lbs.	
To balance this weight and its friction,	15.88 „	
Total,	118.88 lbs.	
Friction due to each bar,		1.78 lbs.

CHUTE No. 4. (Fig. I, Plate IV.)

The centre of gravity of the load was 5.89 feet from the axis: to raise 257 lbs. and overcome the friction of 43.81 lbs. required	51.07 lbs.	
Friction due to this,		0.76 lb.
Add as before,		43.81 „
Total friction due to constant weights,		44.57 lbs.
For each bar of lead added,—		
Weight of the lead,	103.00 lbs.	
To balance this weight and its friction,	17.74 „	
Total,	120.74 lbs.	
Friction due to each bar,		1.81 lbs

CHUTE No. 5. (Fig. I, Plate IV.)

The centre of gravity of the load was 4.84 feet from the axis: to raise 257 lbs. and overcome a friction of 43.81 lbs. required	62.15 lbs.	
Friction due to this,		0.93 lb.
Add as before,		43.81 lbs.
Total friction due to constant weights,		44.74 lbs.

For each bar of lead added,—

Weight of the lead,	103.00 lbs.	
To balance this weight, and its friction, required,	21.59 ,,	
Total,	124.59 lbs.	
Friction due to each bar,		1.87 lbs.

The water delivered through Chutes Nos. 5 and 6, acts principally by impulse, at nearly the extremity of the radius of the wheel; this remark applies to No. 5, more exactly, when the head of water above the aperture is considerable; for all heads above four feet, the centre of force was taken at nine feet from the axis.

Not only is the arm of the lever, upon which the water from apertures Nos. 5 and 6 acts, greater, but the direction of the impulse does not coincide with that of gravity, hence the amount of pressure is not the same with the weight, or the ratio of friction to the weight must be diminished. The friction for Chute No. 6, and for Chute No. 5, when the head is more than four feet, may be taken at three-fourths per cent of the weight. The amount of friction being but small, nice calculations upon these points would have been entirely useless.

CHUTE No. 5.—When the head is above four feet.

To raise 257 lbs. and overcome a friction of 43.81 lbs. requires a weight of water, at 9 feet from the axis, of	33.42 lbs.	
Friction upon this at three-fourths per cent,		0.25 lb.
Add as before,		43.81 ,,
Total friction due to constant weights,		44.06 lbs.

For each additional bar of lead,—

Weight of bar 103 lbs. friction at one and a half per cent,		1.54 lbs.
To balance this weight and its friction, required	11.62 lbs.	
Friction upon this at three-fourths per cent,		.09 ,,
Friction due to each bar,		1.63 lbs.

CHUTE No. 6. (Fig. I, Plate IV.)

The friction was sensibly the same with that for Chute No. 5, when the head at that chute was above four feet. Hence, the friction due to the constant weights was,	44.06 lbs.
And the friction for each bar of lead,	1.63 lbs.

CHUTE No. 7.—Undershot.—(Fig. I, Plate IV.)

Here the water acting entirely by impulse, the centre of force may be assumed at 9.75 feet from the axis.

To raise 257 lbs. and overcome a friction of 43.81 lbs. required, at 9.75 feet from the axis, a weight of -	30.85 lbs.	
Friction upon this at three-fourths per cent,		0.23 lb.
Add as before, - - -		43.81 lbs.
Total friction due to constant weights, -		44.04 lbs.

For each bar of lead added,—

Weight of bar 103 lbs. Friction upon this at one and a half per cent, - -		1.54 lbs.
To balance this weight and its friction, required - - -	10.72 lbs.	
Friction upon this at three-fourths per cent,		0.08 ,,
Friction due to each bar, - - -		1.62 lbs.

The foregoing calculations were applicable until nine leads, (927 lbs.) had been added to the constant weight in the basket; this weight suspended the end, *o*, (Plate III. Vol. vii.) of the shaft of the wheel. Any addition of weight to this, pressed the gudgeon against its cap with a force which was to the tension of the chain produced by the weight added, as the distance from the point at which the chain acted to the other gudgeon, (*o′*, Plate III.) was to the whole length of the shaft. The whole length of the shaft was 9.25 feet, the point of suspension 1.66 feet from the end *o*, of course 7.59 feet from *o′*. If one lead of 103 lbs. be added to the nine supposed in the basket, the force drawing the shaft upwards will be 103 lbs. together with its friction 1.54 lbs. or 104.54 lbs.; to find its effect upon the gudgeon, *o*, we have the proportion, 9.25 : 104.54 : : 7.59 : 85.78, the force, in pounds, with which the gudgeon, *o*, is pressed against its cap. Subtracting this weight from 104.54 lbs. the total weight from which both the gudgeons are relieved, there remains 18.76 lbs. the force tending to draw the gudgeon *o′* upwards, or the weight from which that gudgeon was relieved.

To ascertain the friction when more than nine leads were added to the constant weight in the basket, we have,

Friction due to the weight of each lead of 103 lbs. - - - -			1.54 lbs.
Tension of chain between axis of wheel and drum pressing upon the gudgeons of the drum, - - - -		104.54 lbs.	
Force with which gudgeon *o* was pressed against its cap, -	85.78 lbs.		
From this deduct the weight from which the gudgeon *o′* was relieved,	18.76 ,,		
There remains the pressure upon the axis of the wheel, - - -		67.02 lbs.	

Total pressure upon the gudgeons of the

wheel and drum, by the addition of each lead after the ninth, - - -	171.56 lbs.	
Friction upon this at one and a half per cent, -		2.57 lbs.
Friction due to each lead after the ninth, exclusive of the water required to overcome this friction, - - -		4.11 lbs.

When the water was admitted to the wheel through CHUTE No. 1.

To overcome 103 lbs. and the friction of 4.11 lbs. or 107.11 lbs., required, at 6.207 feet from the axis, - -	17.26 lbs.	
Friction due to this, - -		0.26 lbs.
Friction just determined, - - .		4.11 lbs.
Total friction for each lead after the ninth,		4.37 lbs.

The friction due to the weight of water necessary to balance each additional lead and its friction, was so small that its variations when the water was applied through the different chutes, could with propriety be neglected. The variation from the friction given by Chute No. 1, in an extreme case, that of Chute No. 5, at a friction of one and a half per cent, is but .07 of a pound. The friction for each lead after the ninth, was, therefore, taken at 4.37 lbs. at all the chutes.

The necessary details in relation to the friction of the several smaller wheels, will precede the account of the experiments made with each of them.

Before passing to a detail of the experiments, it may assist the reader to give a brief statement of the principal points to which the researches of the committee were directed.

The first and most general subject for determination, was the mode of applying any given head of water, so as to produce the greatest ratio of effect to power expended.

To ascertain this point, regard was to be had to, and variations made in, the head of water, the diameter of the wheel, the point of application of the water to the wheel, the size of aperture through which water was admitted to the wheel, the form of gate which was applied to the chute, the form, number and position of the buckets, and the velocity of the wheel.

The second object was to determine for a given wheel, the form of bucket which would admit of the application of the greatest quantity of water, giving the maximum amount of effect, without diminishing the ratio and effect to power expended.

Wheels of four different diameters were used in the experiments; No. I, had a diameter of 20 feet, No. II, of 15 feet, No. III, of 10 feet, and No. IV, of 6 feet. A particular description of each wheel will precede the statement of the experiments made with it.

The experiments were begun with wheel No. I; this wheel, as has been stated in the general description, was 20 feet in diameter, 20 inches in breadth, and 16 inches, in the clear, between the cants, which were 6 inches deep.

The buckets first attached to this wheel were *elbow buckets*, these were 15½ inches deep, with a width of elbow of 3 inches, and an opening at the throat of 2⅝ inches. In sector A, B, C, (Plate IV,) these buckets are represented, *e*, *e*, &c.: the number around the whole circumference was fifty.

In the bottom of each bucket an air vent was provided, ⅜ths of an inch wide and occupying the breadth of the wheel; each vent was placed in the upper part of the bucket, to which it belonged, as near as practicable to the elbow of the preceding bucket. The air vents were closed during the experiments when the contrary is not stated.

The overshot chute, delivering water to the wheel on the pitch-back principle, is represented at *d*, No. 1, Fig. I, Plate IV.

To this chute three different forms of gates were applied. The first, *a*, Fig. I, Plate IV, was formed of a block three inches thick, and was opened by a motion towards the right, given by the series of levers, *l*, *l′*, *l″*, K, Plate I, (Vol. vii.) already described. The width of opening given by this gate was regulated by a series of notches upon a block, affixed to the top of the forebay, against which the end of the connecting rod, *l′*, *l″*, (Plate I,) was carried. These notches were regulated by trial. The same method of gauging the width of the opening was applied to the other apertures. When gate *a* was opened, the water flowed between its end and the top of the chute. Table A contains the results of the experiments made with this gate, under different heads.

This series of experiments being completed, the gate *b*, Fig. II, Plate IV, was adapted to the same chute; this gate drew upwards, allowing the water to pass between the lower part of the gate and the floor of the chute. Experiments similar to those, with gate *a*, were then made; the results are given in table B.

Gate *c*, Fig. III, Plate IV, was next adapted to the same chute; this gate, of a wedge form, being drawn to the right, allowed the water to pass between the tops of the gate and of the sluice. Table C contains the results obtained with this gate.

The elbow buckets remaining in the wheel, experiments were made with different heads and different widths of aperture, the water being applied at Chutes Nos. 2, 3, 4, 5, 6, and 7 successively. These points of application, taken together with Chute No. 1, embraced the cases of overshot, breast and undershot wheels. The heights of the several apertures above the lowest point of the wheel are, No. 2, 17 feet; No. 3, 13.66 feet; No. 4, 10.46 feet; No. 5, 7 feet; No. 6, 3.66 feet. No. 7 was the undershot aperture. The horizontal lines *f g*, *h i*, *k l*, *m n*, and *o p*, show the points from which these several heights above the bottom of the wheel were reckoned. The chutes through which the water was delivered from these openings, were at the entrance 16 inches by 2½ inches, and contracted in depth (the width remaining invariable) to 2 inches, at the end where the water escaped to the wheel.

The three forms of gates (*a*, *b* and *c*) having been found nearly equally effective, either one could be applied as the convenience of opening and closing, in the position to be assumed by the gate might dictate. Fig. I, Plate IV, shows that Chutes Nos. 2, 3 and 7, were closed by gates similar to *b*, and chutes Nos. 4, 5 and 6, by gates similar to *c*. The experiments with each chute, under the various heads, will form the subject of one table.

The required results having been obtained with the elbow buckets, they were removed from the wheel, and the buckets represented in sector F, C, G, (Fig. I, Plate IV,) substituted, the faces converging to the centre of the wheel. The different heads of water were then tried with each chute, and with different widths of aperture, as before. These experiments will be presented with the others in a tabular form.

Air vents, similar to those already described, were provided in the bottoms of these buckets.

The series of experiments, with the *centre buckets* having been completed, the buckets figured in sector D, C, E, (Fig. I, Plate IV,) and afterwards those in sector H, C, I, were substituted. If from any point in the periphery of the wheel, two tangents be drawn to a circle, described with the centre of the wheel as its centre, and a radius of 15½ inches, we shall obtain the lines determining the two different buckets for that point; each bucket being equally inclined to, but on different sides of, the radius of the wheel drawn to the point, assumed, in the periphery. In sector D, C, E, the tangents to the upper side of the circle are drawn, determining the positions of the first set of *inclined buckets*. In sector H, C, I, the tangents to the lower side, giving the second set of inclined buckets.

In presenting the results of the experiments, each table will contain a single subject, and will be designated by a letter serving as a reference. To accommodate the tables to the size of the page, they will be divided into parts, designated by numbers. The general tables, as may be seen by table A, Part I, consist of 18 vertical columns, and in addition, a space for observations; each column has, at the bottom of the table, its appropriate figure of reference.

Column 1, contains the numbers by which any particular experiment may be referred to; the experiments are numbered from one upwards, through the whole extent of a table. The next three columns refer to the head of water used; column 2, containing the heights of water above the aperture; 3, the height above the top of the bucket, at which the water first strikes the wheel; and 4, the height above the bottom of the same bucket. The heads above the apertures were measured in apertures, Nos. 1, 2 and 3, by the heights above the lowest points of the tops of the gate-seats, in Nos. 4, 5 and 6, by the heights above the lowest points of the several gates when closed, and in No. 7, by the height above the bottom of the forebay, which was on a level with the bottom of the wheel. The lines *fg*, *hi*, &c. already referred to, are drawn through the points just designated, corresponding to apertures, Nos. 2, 3, 4, 5 and 6. The head, above the top of the bucket, was estimated for the overshot aperture, (No. 1,) by the height of the water above the highest point of the wheel; and that above the bottom of the bucket, by the height above the highest point of the soleing of the wheel. The heads, above the tops of the buckets, upon which the water first struck, were estimated for apertures, Nos. 2, 3, 4, 5 and 6, by the height of

Plate IV.

Fig. II

Fig. I

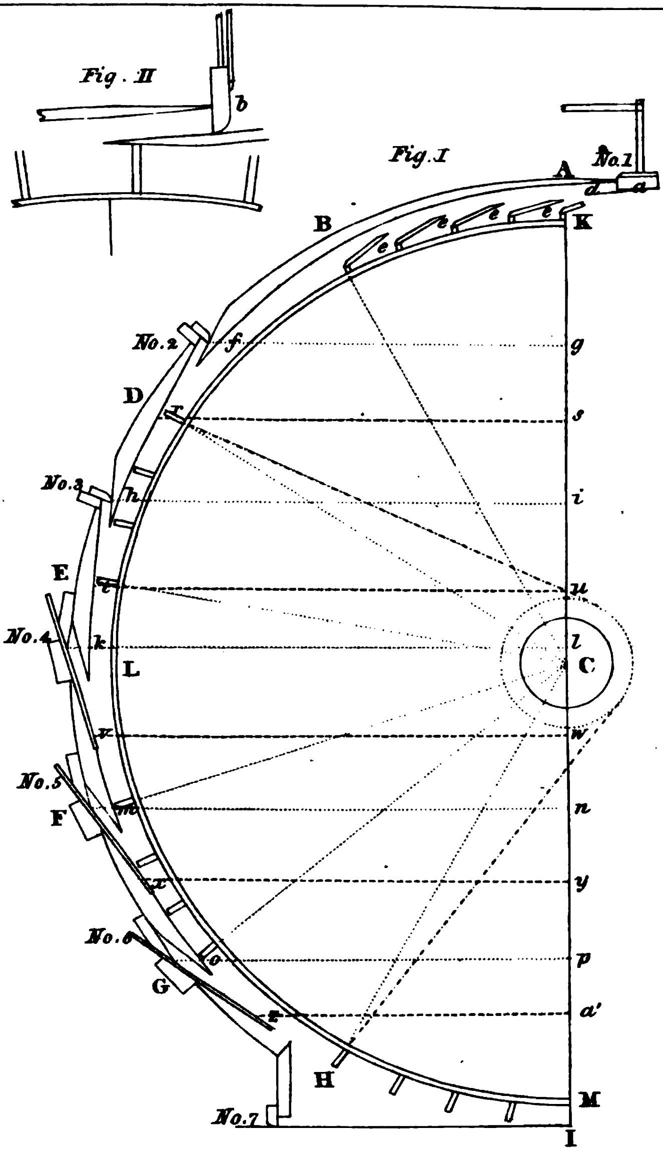
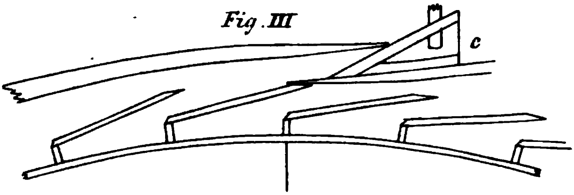


Fig. III



Scale ⅛ inch to the foot.

the water, above a point in each aperture, one-half of an inch distant from the periphery of the wheel; the horizontal lines drawn through these points are shown in Fig. I, Plate IV, by *rs*, *tu*, *vw*, *xy*, and *za'*. By adding the vertical distance between the top and bottom of the bucket at any aperture, to the head, found as just described, the head, above the bottom of the bucket, was obtained. The heads thus found are contained in column 4. In a wheel considered at rest, the point corresponding to the bottom of the bucket, at which the water was delivered, would give the first point of action of the gravity of the water upon the wheel; but when the wheel is in motion, this point is generally lower down than the point which we have determined, the distance depending upon the depth of the bucket, and upon the relative velocities of the water and wheel. All the dimensions referred to, are given in feet, and decimal parts of a foot.

Column 5 contains the width of aperture, regulated by the distance to which the gate was drawn, determined in the manner already explained. The openings were increased by determinate differences, until the supply of water was more than sufficient to fill the buckets. The widths of the openings are given in inches and decimals.

The weight raised is given in column 6; this was varied with each head and aperture, until the maximum effect was reached and passed.

The friction, the method of calculating which has been given, for the machine under the particular weight raised, is contained in column 7.

Column 8, is the sum of the weights found in 6 and 7 for the different cases; the numbers represent, therefore, the total resistance overcome by the power. The weights are all given in pounds and decimals of a pound.

Column 9 contains the height through which the several weights were raised, combined with 8, it gives the effect produced.

The time occupied in each experiment is recorded in column 10, in seconds.

By dividing the distance through which the weight was raised, by the number of seconds required to raise it through that distance, the rate per second, or velocity of the weight, was determined. The velocity of the wheel will of course bear the same proportion to that of the weight, as the radius of the wheel to the sum of the radii of the barrel and chain. To avoid any uncertainty in relation to this latter quantity, the ratio was obtained experimentally, by ascertaining the number of revolutions, and parts of a revolution of the wheel, required to raise the weight through a measured distance. The velocities of the wheel are given in column 11.

The weight of water expended in each experiment, determined by measurement of its bulk in the reservoir, is contained in column 12. It was a question, whether in these experiments which would occupy a period extending through a considerable range of temperature, it was necessary to apply a correction for the temperature of the water used, the water expended being measured, not weighed. Calculation showed that no such correction was necessary.*

---

* The temperature of the water used, was, during the winter, about at its point of maximum density, in the summer, not far from 75° Fahr. Calling the specific gravity of water at 39.38° Fahr. its point of maximum density, unity,

Column 13 contains the head and fall, expressed in feet and decimals.

By multiplying the numbers of column 12, by the corresponding heads and falls from 13, the powers expended were obtained; the numbers expressing them are in column 14. The decimal point is omitted in this and in the succeeding column, as being unnecessary to the determination of the ratio.

Column 15 contains the numbers denoting the effect produced; these were obtained by multiplying the corresponding numbers in columns 8 and 9.

The next column, 16, gives the ratio of effect to power expended, the power being taken as unity.

The maximum effect under each head and width of aperture, is placed in column 17, that reference may be more readily made to the several maxima.

Column 18 contains the velocity of the wheel, which gave the maximum in each case.

The observations made during the progress of the experiments, are recorded in the remaining space.

Two experiments were always made under the same circumstances, when the results of these agreed it was not deemed necessary to make a third, but when they were discordant, a third, and, when required, even a fourth experiment was made to ascertain the point in doubt.

To give the two or three experiments made in each case, would be to add unnecessarily to the space which the tables must occupy: the numbers given are to be considered as so many mean results taken by those who, having been actually engaged in the course of experiment, could duly appreciate the circumstances rendering expedient the rejection of any experimental result. The tables thus become more valuable, by being rendered less voluminous and better adapted to practical use.

The tables will be followed by remarks upon them, and conclu-

the experiments of Haellstroem give for its density at 75.2° Fahr. 0.9976. If we suppose two results are to be compared, one obtained at the minimum temperature of the water, the other at the maximum, they will differ but .0024ths of the greater weight. Thus in a weight of water expended, of 10,000 lbs. the greatest difference could be but 24 lbs., or less than one division upon the gauge-plate, a number which would disappear in the ratio. Take, for example, experiment 15, Table A, which gives the highest number, contained in Part 1st, for the weight of water expended; this number is 4810 lbs.: suppose this experiment to have been made when the water was at its maximum density, and let us ascertain what effect will be produced upon the ratio, if this experiment were supposed to have been made with the water at 75.2° Fahr. The weight of water expended, occupying the same bulk with 4810 lbs. at the maximum density of water, would have been at 75.2° Fahr. 4810 × .9976, 4798.456 lbs.; this multiplied by the head and fall, 23 feet, gives for the power expended 110364.49 lbs.; the effect, (column 15,) is 91759.4, the numbers in the columns for power and effect in the table are multiplied by ten to avoid placing the decimal point. But 1103645 : 917594 : : 1 : .831, the ratio sought.

The ratio in the table, (column 16,) is .829, differing but .002 from the number just found: the effect, therefore, of neglecting the change of temperature in this extreme case falls only upon the third decimal place, the figure in which place it alters slightly.

sions drawn from them; when necessary, tables will be given presenting condensed views of particular results which are to be compared with each other.

We proceed to give the tables relating to wheel No. I.

TABLE A.—PART I.

CHUTE No. 1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	0.50	257	44.54	301.54	41.5	33	11.84	835	23.0	192050	125139	.652	- -	- -	Water carried above lower centre of wheel before it was discharged from buckets.
2					416	47.32	463.32		40	9.77	1100		253000	192278	.759			
3					463	48.14	511.14		44	8.88	1200		276000	212123	.768			
4					772	53.54	825.54		69	5.66	1825		419750	342599	.816			
5					875	55.34	930.34		74	5.28	2025		465750	386091	.829	.829	5.28	Water discharged at bottom of wheel.
6					931	56.32	987.32		83	4.71	2200		506000	409738	.809			
7					978	57.14	1035.14		86	4.54	2300		529000	429583	.812			
8					1081	58.94	1139.94		94	4.16	2575		592250	473075	.799			
9	2.75	3.00	3.60	1.00	1493	73.85	1566.85	41.5	68	5.75	3450	23.0	793500	650243	.820			
10					1549	76.22	1625.22		70	5.58	3525		810750	674466	.832			
11					1596	78.22	1674.22		72	5.43	3600		828000	694801	.839	.839	5.43	
12					1699	82.59	1781.59		80	4.88	3925		902750	739360	.818			
13	2.75	3.00	3.60	1.25	1905	91.33	1996.33	41.5	66	5.92	4350	23.0	1000500	828477	.828			
14					2008	95.70	2103.70		70	5.58	4550		1046500	873035	.834	.834	5.58	
15					2111	100.07	2211.07		74	5.28	4810		1106300	917594	.829			
16	2.25	2.50	3.10	0.75	875	55.34	930.34	41.5	57	6.86	2115	22.50	475787	386091	.811			
17					1081	58.94	1139.94		69	5.66	2575		579375	473075	.815			
18					1184	60.74	1244.74		75	5.21	2800		630000	516567	.820	.820	5.21	
19					1287	65.11	1352.11		82	4.77	3050		686250	561126	.817			
20					1390	69.48	1459.48		93	4.20	3330		749250	605684	.808			
1	2	4	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE A.—PART II.

CHUTE No. 1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	2.25	2.50	3.10	1.00	1184	60.74	1244.74	41.5	56	6.98	2775	22.50	624375	516567	.827			
22					1287	65.11	1352.11		60	6.51	3000		675000	561126	.831			
23					1390	69.48	1459.48		65	6.01	3225		725625	605684	.835	.835	6.01	
24					1493	73.85	1566.85		70	5.58	3500		787500	650243	.826			
25					1596	78.22	1674.22		74	5.28	3750		843750	694784	.823			
26					1699	82.59	1781.59		79	4.95	4000		900000	739360	.821			
27	2.25	2.50	3.10	1.25	1390	69.48	1459.48	41.5	51	7.66	3300	22.50	742500	605684	.816			
28					1596	78.22	1674.22		60	6.51	3750		843750	694784	.823			
29					1699	82.59	1781.59		63	6.20	3975		894375	739384	.827			
30					1802	86.96	1888.96		68	5.75	4175		939375	783918	.834			
31					1905	91.33	1996.33		71	5.50	4400		990000	828477	.837	.837	5.50	
32	1.25	1.50	2.10	0.50	669	51.74	720.74	41.5	74	5.28	1660	21.50	356900	299107	.838			
33					772	53.54	825.54		84	4.65	1900		408500	342599	.839	.839	4.65	
34					875	55.34	930.34		94	4.16	2150		462250	386091	.835			
35					978	57.14	1035.14		100	3.91	2540		546100	429583	.787			
36	1.25	1.50	2.10	0.75	875	55.34	930.34	41.5	72	5.43	2150	21.50	462250	386091	.835			
37					978	57.14	1035.14		82	4.77	2350		505250	429583	.850	.850	4.77	
38					1081	58.94	1139.94		90	4.35	2600		559000	473075	.846			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE A.—PART III.

CHUTE No.1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of Wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Top of Bkt.	Btm. of Bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
39	1.25	1.50	2.10	1.00	1081	58.94	1139.94	41.5	68	5.75	2600	21.50	559000	473075	.846			
40					1184	60.74	1244.74		74	5.28	2825		607375	516567	.850	.850	5.28	
41					1287	65.11	1352.11		81	4.83	3100		666500	561126	.842			
42					1390	69.48	1459.48		90	4.35	3400		731000	605684	.828			
43	1.25	1.50	2.10	1.25	1390	69.48	1459.48	41.5	70	5.58	3390	21.50	728850	605684	.831			
44					1493	73.85	1566.85		76	5.14	3650		784750	650243	.828			
45					1596	78.22	1674.22		81	4.83	3825		822375	694801	.845	.845	4.83	
46	0.50	0.75	1.35	1.25	875	55.34	930.34	41.5	62	6.30	2250	20.75	466875	386091	.828			
47					978	57.14	1035.14		67	5.83	2460		510450	429583	.842			
48					1081	58.94	1139.94		70	5.58	2675		555062	473075	.852			
49					1184	60.74	1244.74		77	5.07	2875		596562	516567	.866			
50					1287	65.11	1352.11		88	4.44	3100		643250	561126	.872	.872	4.44	
51					1390	69.48	1459.48		83	4.70	3400		705500	605684	.859			
52	0.25	0.50	1.10	0.75	360	46.34	406.34	41.5	62	6.30	1075	20.50	220375	168631	.765			
53					566	49.94	615.94		93	4.20	1550		317750	255615	.804			
54					669	51.74	720.74		98	3.99	1800		369000	299107	.810	.810	3.99	Water too low to fill the aperture.
55	0.25	0.50	1.10	1.00	772	53.54	825.54		96	4.07	2025		415125	342599	.825			
56					875	55.34	930.34		104	3.76	2275		466375	386091	.828	.828	3.76	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE B.

CHUTE No. 1.—*Gate b. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of Wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	0.75	1287	65.11	1352.11	41.5	45	8.69	3000	23.00	690000	561126	.813			
2					1390	69.48	1459.48		48	8.14	3200		736000	605684	.822			
3					1493	73.85	1566.85		52	7.52	3375		776250	650243	.838	.838	7.52	
4					1596	78.22	1674.22		55	7.10	3625		833750	594801	.833			
5					1699	82.59	1781.59		59	6.62	3875		891250	739360	.829			
6	2.75	3.00	3.60	1.00	1699	82.59	1781.59		46	8.50	3925	23.00	902750	739360	.819			
7					1802	86.96	1888.96		48	8.14	4125		948750	783918	.826			
8					1905	91.33	1996.33		51	7.66	4330		995900	828477	.832	.832	7.66	
9					2008	95.70	2103.70		55	7.10	4575		1052250	873035	.829			
10					2111	160.07	2211.07		58	6.74	4850		1115500	917594	.826			
11					2214	104.44	2318.44		[illegible]	6.51	5125		1178750	962153	.816			
12					2317	108.81	2425.81		63	6.20	5375		1236250	1006711	.814			
13	1.25	1.50	2.10	1.00	1390	69.48	1459.48	41.5	62	6.30	3400	21.50	731000	605684	.828			
14					1596	78.22	1674.22		71	5.50	3875		833125	694801	.834			
15					1699	82.59	1781.59		74	5.28	4100		881500	739360	.839	.839	5.28	
16					1802	86.96	1888.96		66	5.92	4350		935250	783918	.838			
17	0.75	1.00	1.60	1.25	1287	65.11	1352.11		66	5.92	3235	21.00	679350	561126	.826			
18					1390	69.48	1459.48		71	5.50	3450		724500	605684	.836	.836	5.50	
19					1493	73.85	1566.85		68	5.75	3725		782250	650243	.831			
20	0.50	0.75	1.35	1.25	1081	58.94	1139.94		73	5.35	2775	20.75	575812	473075	.821			
21					1184	60.74	1244.74		78	5.01	3000		622500	516567	.830			
22					1287	65.11	1352.11		84	4.65	3250		674376	561126	.832	.832	4.65	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE C.

CHUTE, No. 1.—*Gate c. Pitch-back over-shot. Elbow-buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	1.00	2008	95.70	2103.70	41.5	69	5.66	4700	23.00	1081000	873035	.808			
2					2111	100.07	2211.07		73	5.35	4900		1127000	917594	.814	.814	5.35	
3					2214	104.44	2318.44		78	5.01	5210		1198300	962153	.803			
4	1.25	1.50	2.10	1.25	1287	65.11	1352.11	41.5	56	6.98	3200	21.50	688000	561126	.815			
5					1493	73.85	1566.85		63	6.20	3580		769700	650243	.845	.845	6.20	
6	1.25	1.50	2.10	1.50	1596	78.22	1674.22	41.5	57	6.86	3875	21.50	833125	694784	.831			
7					1699	82.59	1781.59		61	6.40	4125		886875	739360	.833			
8					1802	86.96	1888.96		64	6.10	4350		935250	783918	.838	.838	6.10	
9					1905	91.33	1996.33		68	5.75	4610		991150	828477	.836			
10	0.75	1.00	1.60	1.25	1390	69.48	1459.48	41.5	77	5.07	3440	21.00	722400	605684	.838			
11					1493	73.85	1566.85		82	4.77	3675		771750	650243	.842	.842	4.77	
12	0.75	1.00	1.60	1.50	1493	73.85	1566.85	41.5	73	5.35	3725	21.00	782250	650243	.831			
13					1596	78.22	1674.22		77	5.07	3935		826350	694801	.841	.841	5.07	
14					1699	82.59	1781.59		81	4.83	4200		882000	739360	.838			
15	0.50	0.75	1.35	1.50	1287	65.11	1352.11	41.5	77	5.07	3285	20.75	681637	561126	.822			Water too low on the gate to fill the buckets.
16					1390	69.48	1459.48		85	4.60	3510		728325	605684	.831	.831	4.60	
17					1493	73.85	1566.85		96	4.07	3825		793687	650243	.819			
18	2.75	3.00	3.60	1.00	1699	82.59	1781.59	41.5	59	6.62	3975	23.00	914250	739360	.809	.809	6.62	Air vents open.
19					1905	91.33	1996.33		67	5.84	4550		1046500	828477	.791			
20					2008	95.70	2103.70		72	5.43	4840		1113200	873035	.785			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Report of the result of experiments made at the United States Navy Yard, Washington City, in order to ascertain the relative strength of rope and chain cables.

THE subjoined report was handed to us by Mr. Judge, by whom the experiments were performed. The machine used for the trials was an excellent one, invented by Mr. Judge, and patented on the 29th of November, 1828. A notice of it will be found in the Journal, for February, 1829.

NAVY YARD, WASHINGTON, 26*th of April*, 1830.

SIR,—Agreeable to your order, I report the following as the results of experiments made in this yard, by order of the Commissioners of the Navy, for the purpose of ascertaining the relative strength of rope and chain cables. Each sample of hemp cable was ten fathoms long when first proved, and six fathoms at second proof. The circumferences were taken before stretched, and progressively until it became dangerous to touch them.

The 1st trial was made on the 10th of April, 1828; when I proved a 16¾ inch hemp cable, containing 1215 yarns, averaging 110¾ lbs., which stretched 11 feet, reduced 2¼ inches, and broke short in the middle with 392 lbs. in the scale; hanging on the index lever. This trial was made under the inspection of captain Stevens.

5th of August, 1829. Proved a 13 inch hemp cable, containing 855 yarns, averaging $114\frac{36}{100}$ lbs. which stretched 13 feet, reduced 2 inches, and broke with 175 lbs. in the scale.

6th of April, 1830. Proved an 11⅓ inch hemp cable, containing 554 yarns, averaging $124\frac{26}{62}$ lbs. stretched 9 feet, and reduced 1⅞ inch, when it broke within the splice, with 156 lbs. in the scale; it was spliced and attached to a chain of 1⅞ inch wire, delivered by Penfield and Taft, when the rope broke in the splice with 190½ lbs.

Proved a 15 inch cable containing 901 yarns, averaging $120\frac{87}{100}$ lbs. stretched 12 feet, reduced 3 inches, and broke abreast of the splice with 227 lbs. in the scale; reconnected to a 1⅛ chain, made of Peru iron, when the chain broke with 284 lbs. (this link was very short grained;) reconnected the same rope and a 1⅞ chain of Peru iron, when the rope broke with 336 lbs. in the scale.

Proved a 16¾ inch cable, containing 1203 yarns, averaging $142\frac{32}{133}$ lbs. (made by Herron of Norfolk,) which stretched 10 feet 8 inches, reduced 2⅛ inches, and broke abreast of the splice with 435 lbs.; reconnected to a chain 1⅞ inch wire, Peru, which broke with 270 lbs. with one strand of the cable; replaced it with a new link, and spliced the cable, it being reconnected, the new link broke with 248 lbs.; then attached the cable to an 1⅞ chain, when the cable broke with 452 lbs. in the scale.

Proved a 17¾ inch hemp cable, containing 1514 yarns, averaging $120\frac{141}{168}$ lbs., stretched 9 feet 8 inches, reduced 1¾ inch, and broke clear of the nip with 389 lbs.; spliced and connected to a piece of 1¼ chain, of Peru iron, when the rope broke abreast of the splice with 418 lbs. in the scale; the chain was much injured, showing the rope and chain nearly of equal strength.

Proved a 20¾ inch cable, containing 1825 yarns, averaging 120$\frac{153}{203}$ lbs., stretched 11 feet 10 inches, reduced 2¾ inches, and broke short about 7 feet from the splice with 550 lbs.; it was again spliced and attached to Penfield and Tafts 1$\frac{9}{16}$ chain, and a piece of Peru chain of 1½ wire, when the rope broke close to the splice with 481 lbs. in the scale.

Proved a 22 inch cable, containing 2236 yarns, averaging 111$\frac{213}{250}$ lbs., stretched 14 feet, and reduced 3¼ inches. This cable had several trials, in consequence of which it may be thought proper to add 10 lbs. to the greatest weight it bore, which will make the strength of the cable equal to 661 lbs. in the scale, (as will appear by the following statement:)

At the 1st trial, a rivet in the proving chain broke with 553 lbs.; connected, when another rivet broke with 561 lbs. 3d trial, three rivets broke with 651 lbs. I then had the holes reamed and larger rivets substituted, when the cable broke with 557 lbs. which shows that the rope was nearly gone when it raised 651 lbs.

Having respliced the same cable to 6 fathoms, and connected it to a piece of Peru chain of 1⅞ wire, and a piece of Penfield and Taft's of 1⅝ wire, the rope broke in the middle between both splices with 437 lbs. in the scale.

Proved a 25¾ inch hemp cable, containing 2849 yarns, averaging 124$\frac{147}{320}$ lbs., which stretched 11 feet 10 inches, reduced 2¾ inches, and broke with 642 lbs. in the scale. This cable was attached to a piece of 1⅞ inch chain Peru iron, a piece of 1$\frac{9}{16}$ Penfield and Taft's, a piece of 1¾ English, and a piece of 1⅞ Ridgly's, with links and shackles from the latter, of 2 to 2¼ inches, which broke in the following order:

1st. trial a shackle of Ridgley's broke with		499 lbs.
2nd. do. a 2 inch connecting link	do. do. do.	553 do.
3d. do. a 2¼ inch shackle of	do. do. do.	566 do.
Do. do. Penfield & Taft's cracked, not parted	do.	566 do.
4th. do. a shackle of Ridgley's	do.	535 do.
5th. do. Penfield & Taft's	do.	539 do.
6th. do. a shackle of 2¼, Ridgley's		473 do.
7th. do. a Peru link of 1⅞ inch		642 do.
8th. do. the rope broke clear of the splice with one strand at the other end,		571 do.

This cable having so many shocks, and the injury received by the recoil each time the chains broke, it is supposed that adding 52 lbs. to the weight raised at the 7th trial, would have broken it at that time, making the strength of the cable equal to 694 lbs. in the scale.

In conclusion of this report, I would beg leave to suggest the propriety of having the chain cables made larger, as the sizes now made are much smaller than are used by any other nation, for the same classes of vessels. By increasing the size there would be no loss by the chains already made; as the 1⅞ inch chains intended for 74's are but the common size for 44's, those for 44's being transferred to 36's, and so on in rotation.

There is another object worthy of consideration, though seemingly trifling still of great importance: In ordering chain iron there is no allowance made for wastage, as the iron when delivered, is but the neat size or what the chain should be when finished; which renders it necessary that the iron should be ordered $\frac{1}{16}$ of an inch larger than the intended sizes of the chains.

A sheet of iron $\frac{1}{32}$ of an inch thick, and $6\frac{1}{4}$ inches wide, will require 15,625 lbs. to tear it asunder, (agreeable to the statements of several authors,) it will therefore be perceived that a $\frac{1}{16}$ loss in the diameter of a chain is of great importance.

Respectfully yours, &c.
(Signed,) John Judge.

Commodore Isaac Hull.

I respectfully submit for your consideration the following table of proportions for hemp and chain cables, and the sizes of iron before made into chains.

Circumference of rope in inches.	Diameter of chain in inches.	Size of iron before made into chains.
$10\frac{1}{2}$	1	$1\frac{1}{16}$
11	$1\frac{1}{16}$	$1\frac{1}{8}$
12	$1\frac{1}{8}$	$1\frac{3}{16}$
13	$1\frac{1}{4}$	$1\frac{5}{16}$
14	$1\frac{5}{16}$	$1\frac{3}{8}$
15	$1\frac{3}{8}$	$1\frac{7}{16}$
16	$1\frac{1}{2}$	$1\frac{9}{16}$
17	$1\frac{5}{8}$	$1\frac{11}{16}$
18	$1\frac{11}{16}$	$1\frac{3}{4}$
19	$1\frac{3}{4}$	$1\frac{13}{16}$
20	$1\frac{13}{16}$	$1\frac{7}{8}$
21	$1\frac{7}{8}$	$1\frac{15}{16}$
22	$1\frac{15}{16}$	2
23	2	$2\frac{1}{16}$
24	$2\frac{1}{16}$	$2\frac{1}{8}$

Respectfully yours, &c.
(Signed,) J. J.

Commodore Isaac Hull.

On the Rapid Movement of Boats on Canals.

A work has recently appeared in London entitled "Remarks on Canal Navigation, illustrative of the advantages of the use of steam as a moving power on canals. By William Fairbairn, Engineer;" which details several experiments made on the Forth and Clyde, Union, Markland, and Androsson canals, manifesting that a high degree of speed may be attained in the navigation of canal boats, without injury to the banks. Some notices upon these subjects have appeared in the public papers, and extracts have been made from the work in a recent report of the Managers of the Chesapeake and Ohio Canal Company, which are well calculated to arrest the public attention. The subject is rendered particularly interesting at a period when the battle has waxed warm between the advocates of rail-roads and of canals; and should it appear, as the experiments alluded to tend to prove, that boats moving at the rate of ten or twelve miles an hour, produce less agitation in the water, and consequently less injury to the banks than with only a half or one-third of this velocity, an important point will be gained by the friends of canals; we think it improbable that a greater degree of speed than this upon rail roads, although a much greater has been attained, will not be found eligible. "The Ardrossan canal is throughout very narrow; at the bridges and many other places it is only nine feet broad. It has a great number of turns, and many of them are very sudden." On this canal a velocity of twelve miles an hour has been attained by a boat in which there was a steersman and eight other persons; "the boat accomplished a distance of two miles, with one horse, in ten minutes, without any surge, or agitation of the water injurious to the banks."

The summary of the results from the first experiments on the Forth and Clyde canal, embraced three objects worthy of particular notice, as this author very justly affirms: "First, the ease with which the boats were brought up, or stopped, when moving at a high rate of velocity; secondly, the little additional labour, in drawing, occasioned to the horse, when drawing the boat at this high rate, as compared with a low rate of velocity; and thirdly, the apparent diminution of the surge, or agitation in the water, at a high rate of velocity."

Since these experiments, a boat has been regularly "plying between Glasgow, Paisley, and Johnston, on the Ardrossan canal," and carrying "from forty to fifty passengers, at the rate of from nine to ten miles an hour."

The following experiments were made on the Forth and Clyde canal.

"On Wednesday, the 7th of July, the Swift, a boat 60 feet long and 8 feet 6 inches broad, twin-built, and fitted to carry from fifty to sixty passengers, started from Port Dundas, at 16 minutes past 9 in the morning, having on board thirty-three passengers, (all men,) and their baggage. Proceeding through the Forth and Clyde, and Union Canals, she reached Edinburgh at 29 minutes past 4 in the afternoon. She thus made a voyage of 56 miles and a half in the space of 7 hours and 14 minutes. In the course of this voyage, she passed through fifteen locks, eighteen draw-bridges, a tunnel 750 yards long, and over three long narrow aqueducts, and under sixty common bridges, which carry roads over the Union Canal. Her average rate of speed, during the voyage, was nearly eight miles per hour, including every stoppage.

"On the following day, Thursday the 8th of July, the Swift started from Edinburgh, 22 minutes past 9, in the morning, and returning by the same route, with 33 passengers, (all men,) and luggage, she reached Glasgow precisely at 4 o'clock in the afternoon—that is, in 6 hours 38 minutes; going thus at the rate of nearly 9 miles per hour." "On both days the weather was most unfavourable, from much rain, and a strong gale of wind, directly in her face, having been from the east on Wednesday, and from the west on Thursday." "When free from the locks, tunnel, and other impediments, the speed at which she proceeded varied from 6 to 12 miles an hour; and the extraordinary results of the previous experiments made on the Paisley canal, and Forth and Clyde canal, were again completely verified and ascertained during her progress through 113 miles of canal navigation. For it appeared that when she moved through the water at the rate of 6 or 7 miles per hour, there was a great swell or wave constantly in her front, and she was followed by a strong surge or wave, bearing against the bank of the canal. At these times the hauling rope was tight, and the horses appeared to be distressed. But as the speed was increased, the wave or swelling of water in her front sunk down; and when the speed came to be about 9 miles an hour, the swell entirely disappeared, the waters in front became smooth and level; the hauling rope slackened, and the horses seemed easy, and little or no surge was to be seen on the banks behind the vessel."

On these experiments, the following comment is made by the same writer: "There appears, therefore, no reason to fear, that the banks of canals can ever be hurt, by increasing the speed of boats, to the utmost attainable height; and measures are in progress for increasing the speed of passage boats on the Forth and Clyde canal, and the Union canal; or at least of keeping it, during the whole voyage, between Glasgow and Edinburgh, to the highest rate, which has been already realized; and thus, reducing the time consumed in the voyage, to five hours."

To these experiments, Mr. Fairbairn has added many others which are referred to in the text, and more minutely described in the appendix of his very interesting work; and from them he deduces results confounding all the established theories "that the resistance, to a body, drawn along a line of water confined within the banks of a canal, did not appear to increase in the ratio, laid down in theory; and that, while at a low rate of velocity, viz: at, and under 6 miles an hour, the resistance to the progress of the boat, on a broad line of water, was considerably less than on a narrow line; on the contrary, at a high rate of velocity, say above ten miles an hour, the forces necessary to the propulsion of the boat, on a broad, and narrow line of water, appeared to be the same if the advantage was not rather in favour of the narrow line."

From these observations he was induced "to recommend, and the Forth and Clyde canal company to agree, to build a light twin iron steam passage-boat, to ply between Glasgow and Edinburgh," which, at the date of his publication, he was preparing to launch. "Her length is to be 68 feet, her breadth of beam 11½ feet, her steam engine to be of 10 horse power; the diameter of her paddle wheel 9 feet;" "and its motion calculated to give from 50 to 60 strokes in the minute; her whole weight 7 tons 16 cwt. and her draft of water 16 inches. She will accommodate from 100 to 150 passengers; her anticipated velocity will be from 9 to 10 miles an hour, and the cost to the canal company, for the conveyance of a passenger, between Edinburgh and Glasgow, 56 miles, will not much exceed 2 pence; which," Mr. Fairbairn adds, "is not a fifteenth of the expense of the conveyance of the same person, at the same rate, supposing it attainable and maintainable by horses."

Mr. Fairbairn says, "that however much he was persuaded that steam power was the cheapest for high velocities, and also for propelling vessels in canals, where the trade was regular, I was not till lately prepared to consider a steam boat, on a canal, as the cheapest, for the conveyance of goods where the trade was irregular, and where the boat had not only to contain a cargo, but at the same time to carry her own engine, and all the conveniences necessary for the application of machinery."

But he proceeds—"Mr. Grahame has lately put into my hands a letter on this subject, addressed to a shipping company, carrying goods along a line of canal 56 miles in length; the calculations contained in that communication are given in the Appendix, and seem to be decisive in favour of steam power. The company, to which this letter is addressed, have to pay for a quantity of horse power, sufficient to deliver 40 tons of goods at each extremity of this line, of 56 miles, every day in the year; besides a spare power employed chiefly in one particular branch of their trade.

The sum they paid for each delivery is one guinea, each way, or at a rate of about one-ninth of a penny per ton, per mile, for the trackage of the goods conveyed. The company, in question, supplying the tracking lines, but, with this addition, the charge for trackage is not increased to one-eighth of a penny per ton, per mile.

"This," says Mr. Fairbairn, "is certainly a small sum whereon to effect a saving by a change of power; but, nevertheless, it appears (from Mr. Grahame's and my own calculations) that not only such saving may be effected, but an additional saving of a large portion of time can be made, by the change from horse to steam power.

"The calculations here referred to make it quite unnecessary," adds the writer, "to say any thing on the subject of *steam power*, as a substitute for trackage, on canals. If *it* be so much cheaper than horses, in the expensive shape of a moving and carrying power, *united in the same boat*, what advantages may not all canals derive from its introduction, in the cheap form of a tug boat, in place of horses?"

In his Appendix, the author adds, "I am the more convinced of the efficacy of steam trackage, above all others, from the circumstance that the train of boats intended to be towed would follow in each other's wake; as the eddy formed by the leading vessel materially lessens the resistance opposed to the succeeding boats." "The small amount of power required to tow a vessel, was remarked by Mr. Grahame in his account of the voyage of the Cyclops, from Alloa to Port Dundas:" "he states, 'when we brought her into the canal, we attached her to the passage boat, and she drew her along the canal 2 miles—1 mile in 14, and the other in 15 minutes. We then detached her from the passage boat, and did two other miles, but could not save, by this decrease of labour, more than a minute, or a minute and a few seconds, in each mile.' One thing is very evident," says Mr. Fairbairn, "that the introduction of steam, instead of animal power, would dispense with the annual repairs and maintenance of the horse paths; the complaints and delays arising from drivers, horses, &c. would be avoided, and many contingent expenses saved by the introduction of this never failing and very effective agent, as a moving power for the towage of boats on canals."

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks upon Bent Axles and Dished Wheels, in reply to the observations of Mr. J. S. Fry, *of Bristol, England. Published in the Journal of the Institute for May last. Page* 358.

To the Editor: Sir,—If I understand the meaning of Mr. Fry, it appears to me that the positions he has taken are erroneous. He seems to assume that wheels are conical on the face or tread, because they are dished in the spokes, that is, because the spokes are set at an angle with a plane, perpendicular to the hub. This, I conceive, does not follow, and however the construction of wheels may be in England, I am greatly mistaken, if the felloes and tire of all carriage wheels in America are not as truly cylindrical as they can be made, and that no such grinding, as he mentions, takes place in this country.

Where roads are paved, or covered, as they mostly are in England, and present laterally a nearly level surface, it may be less necessary to dish carriage wheels—but, in all countries, where wheels are subject to much side thrust, dishing of wheels outwardly, appears to be absolutely necessary: for, if I understand the subject rightly, in that form consists much of the ability of the structure to sustain the lateral pressure which is always applied to those wheels toward which the load inclines, in proportion as the vehicle is jostled, or conveyed over a side-long track. The spokes being set dishing or conical, they cannot be forced into a circular plane, without bursting the tire, if it be well applied to a well constructed frame. In this, I see no reason for supposing that the tread of the wheel is not perfectly cylindical, as I believe they are, and that they produce no such grinding, or tendency to roll out of a straight line, as the author supposes.

He further says, "it appearing then that the cylindrical wheel only has a natural tendency to roll straight forward, all carriage wheels ought to be so constructed. Consequently, the ends of *the axles ought not to be conical, or tapered, nor bent down.*" He seems to argue, that as cones incline to roll only in circles, that tapering and bent axles incline in the same way, even when the boxes are in like manner conical. If this be his position, I think it an erroneous one. I conceive, of a tapering axle divided into an infinite number of rings or frustums, and the box or boxes divided into rings or frustums, corresponding to those in the axle, there can be no tendency conceived of, that will cause any part of the axle to encroach upon that part of the box, assigned to any other division. Although rolling cones incline to circles, turning cones have no such tendency that can be conceived of. Hence then it appears that there is no disadvantage, such as he conceives, resulting from the tapering or conical shape of the axle. I now propose to show that it is necessary.

A determinate size of wood or metal is necessary to be assumed in the axle, not only to bear the load intended to be placed upon it, but as the hubs seldom equal in length the radii of the wheels, the side thrust of the vehicle must operate to break the axle at the shoulder, in a correspondingly greater proportion, by the leverage thus acting upon the strength of the axle. The necessary size of the axle at the shoulder being assumed, and as the whole stress of side thrusts being applied at the shoulder, all the size intended to resist that stress may be safely dispensed with at the linch-pin, or point of the axle, where neither the weight nor thrusts act under circumstances to break the axle, the strength of the hub preventing such an occurrence, where the axle and hub correspond throughout. From the principles of wheels and axles, I argue, that it requires less force to overcome the friction of the box upon the axle, where the box and axle are small, than where they are large. Hence, I conclude, that as there is no disadvantage in tapering the axle, it is proper to do so, in order to avail ourselves of this circumstance.

Next and lastly, the bent axle. As wheels are dished, this is necessary, to bring the lower spokes nearly, or quite perpendicular under the weight, and as the axle is pointed, it is necessary to give all the cone shape, or slant to the axle on the upper side, in effect to bend it, in order that the weight of the load may not rest on an inclined plane, which would cause the wheel to press against the linch-pin. As Mr. Fry did not argue this point, I conclude that he conceives a straight axle a necessary feature of a cylindrical one. An axle bent downwards, as is the mode of making them, throws perfectly cylindrical tire upon the outer corner, on a road precisely flat; but upon a convex road, the result is a fairer tread than any cylindrical wheel can have with a straight axle. In neither case is there any tendency imparted to the wheel, to move in other than a straight line. If the handles of a wheelbarrow be held as near the road as the axle, and one raised and the other depressed, the effect will be precisely that of a bent axle; but no tendency will be found in the wheel to move out of a straight line. But if the handles be held further from the road than the axle of the wheel, and the barrow inclined in the same way, the effect will be to change the direction of the track. The reasons appear plain. In the first instance, the axle maintains a direction perpendicular, or directly across the track; but in the last instance, the elevation of the handles occasions the inclination of the vehicle to throw the axle not only out of its level position, but out of its straight direction.

I conclude, that axles bent backwards, incline wheels outward, so when the axles are bent forwards, the wheel will incline inwards. Were axles constructed in this way in a small degree, that is, tapered a little more behind than before, they would rarely run off, even were no nut nor linch-pin used; but this would incline the wheel to grind, as complained of by Mr. Fry, in the same small proportion. Axles, however, bent directly upward or downward, I conceive to have no such tendency from rolling merely.

I am not about to enter upon a disputation with Mr. Fry or any other person. I hope, however, to elicit the remarks of those who have a greater share of scientific and practical knowledge of the subject than myself. Respectfully,

JNO. S. WILLIAMS.

Washington, Mason county, Ky., June 12th, 1831.

Description of EBENEZER A. LESTER'S *Pendulum Steam Engine.*

WE have been furnished by Mr. Lester, of Boston, with impressions from the engraving of his pendulum steam engine, together with a pamphlet containing his views upon the subject, and the testimonials of its satisfactory performance from those who have had the instrument in use. From this pamphlet we shall make such extracts as may appear to us sufficient to give a clear idea of the whole, accompanied with such remarks as may suggest themselves in relation to it. If in so doing we dissent from Mr. Lester in some of his theoretical opinions, we wish it to be most distinctly remembered that these differences of opinion have nothing whatever to do with the goodness of his engine; this is a question of practice entirely, the engine has been in use for a considerable length of time, and has given entire satisfaction to those who are well able to form a correct judgment respecting it, and who have no interest to promote but that of truth.

Mr. Lester does not lay claim to the invention of the vibrating cylinder engine, but only to that modification of it which he describes under the name of the pendulum engine. He observes that "In the application of steam power by machinery, it has been the object of all inventors, from the time of Watt to the present, to direct the power of the steam, in the first place, to the production of a rotary motion, and thence to take the motion adapted to produce the effect intended. The material question then, in regard to any plan of a steam engine, is, whether it is well calculated to produce a rotary motion, and that is the best, which gives such a motion in the most direct and simple manner. The pendulum engine is proposed as possessing very important advantages in all the particulars above mentioned."

In a note appended to this paragraph, he makes the subjoined observations respecting the principle upon which the power of steam engines is sometimes estimated, and on the relationship which exists between the boiler and the engine.

"In relation to steam engines, about which so much has of late been said and written, I will here make a suggestion respecting the estimate of the *power* of an engine, in regard to which, there is a great deal of obscurity, and uncertainty, both in contracts and in speculations on the subject. In estimating the power of an engine; for instance, as being equal to that of a certain number of horses, only the diameter of the cylinder and length of the stroke are sometimes given, without taking into consideration, the force of the steam and rapidity of motion, with which the engine is calculated to operate; for it is apparent that doubling the rapidity of the motion of the piston, with the same force of steam to the inch constantly acting upon it, will double the power of the engine, as much as doubling the surface of the piston on which the steam acts, supposing it still to act with the same force upon the square inch. It is evident that the largest cylinder, without an adequate supply of steam, will not make a powerful engine; and on the other hand, that a comparatively small cylinder, with a high pressure of steam, and running with great velocity, would make a powerful one. In estimates of this sort, we must, therefore, take into consideration the extent of the surface of the piston on which the steam acts, the degree of pressure of the steam to the square inch, and the rapidity of the motion of the piston.

"It is a popular error, also, not to distinguish sufficiently, the engine from the boiler, or generator, which is, in fact, as distinct from the engine, as the strength of the mechanic is from the tool with which he works. It may, therefore, not be superfluous to apprize persons, not conversant with steam enginery, that the remarks made above, on the pendulum engine, apply to the engine as distinct from the boiler or generator."

That the errors above alluded to have appeared in the estimates and calculations of individuals is indisputable, but we are not aware that they have prevailed to any extent, nor do we perceive how it is possible that they should do so excepting in the minds of those whose acquaintance with the steam engine is extremely limited. We have always considered the area of the piston, the length of the stroke, the number of strokes per minute, and the elastic force of the steam, as the necessary and usual elements in estimating the power of an engine; and although much which has appeared upon the subject has been very loosely written, the published investigations which embrace it in all its bearings are voluminous. The boiler, or generator, is the very soul, the animating principle, of the steam engine. All the *essential* difference in principle between the low and high pressure engines resides in the boiler, and provided the parts of the engine have sufficient strength, all that is necessary to convert the low into the high pressure engine, is to neglect the condenser, and to increase the fire, so that steam of a higher temperature and greater density may be produced in a given time.

Many of the subsequent observations made by Mr. Lester apply to the vibrating cylinder engine in general, whilst others are more particularly appropriate to his modification of it. The vibrating cylinder has been generally suspended upon trunnions, at or near its middle; the cylinder has also been placed both vertically and horizontally. The peculiar feature of Mr. Lester's engine is the placing of the trunnions upon which it is suspended, and through which the steam is supplied, at the upper end of the cylinder, in order to give it a tendency to vibrate as a pendulum, from which circumstance its name has been derived. Mr. Lester observes, that "One advantage of the pendulum engine is obvious, not only to a mechanic, but to any person not at all skilled in mechanics, on the first inspection of the engine, or even a print of one, namely, the application of the power by connecting the piston rod *immediately* with the crank pin. Here the lever beam, connecting rod, and all the gearing and apparatus of whatever kind, interposed between the piston rod and crank pin, in fixed engines of all descriptions, is at once dispensed with. The cost of maintaining this gearing is thus avoided. This part of the machinery, in fixed engines, is, as every practical engineer well knows, very liable to get out of order, and the engine must occasionally be stopped to repair it. This inconvenience is also saved by the pendulum engine. And then, this gearing or intermediate machinery, in some fixed engines, as, for instance, an engine standing on end, and working upwards by a connecting rod, constantly opposes the motion of the crank, by its gravity, except at the dead points, when the connecting rod is precisely perpendicular. The resistance from this cause is not great, but whatever it may be, it is saved in the pendulum engine. Again, this intermediate gearing is liable to friction, which is a constant impediment that must be overcome by a constant expenditure of power for this purpose. The pendulum engine avoids this impediment. By considering how much power would be requisite to keep this intermediate gearing and machinery of a fixed engine in motion, precisely as it moves when the engine is in operation, some estimate may be formed of the saving of power, made in this particular, by the pendulum engine. This single advantage of that engine, unless it is offset by some important disadvantage, will, the inventor apprehends, be a sufficient ground for a decided preference of it. But it has other advantages which are conceived to be of much greater importance."

In producing a rotary motion from the piston rod of a fixed cylinder, the action of the rod, excepting at the dead points of the crank, is never direct, the bar which connects the piston rod with the crank, always tends therefore to force the piston rod laterally; to prevent this effect, slides, or parallel rods, are provided, upon which a portion of the power is expended. Power is consequently lost both from the angular action upon the crank, and the friction arising from the lateral pressure. "When the connecting rod is three times the length of the crank, (which has been considered by machinists a safe proportion of these parts,) the saving of power, made merely by its direct application in the pendulum engine, is 16 2-3 per cent. When a longer connecting rod is used for the fixed engine, the difference will be less. The connecting rod and crank are, however, very frequently about in the above proportion in fixed engines. This saving is a matter of demonstration by the easy and ordinary process of the resolution of a force, indirectly applied, into the two parts—that which is lost, and that which takes effect. For this superiority of the pendulum engine, therefore, I have only to refer to lines and figures, and a familiar principle in mechanics."

With a fixed cylinder, if the cylinder itself, the stuffing box through which it passes, and its connexion with the slide, or beam, do not all perfectly coincide, there is, consequently, a continued tendency to bend or break the piston rod; and where the strength is such as to resist this, there is yet a great wear of the rubbing parts, and a considerable loss of power. The pendulum engine being to a considerable extent exempt from this lateral pressure, appears by the certificates given, to require packing only one-fourth as often as the ordinary fixed engine.

The tendency of the pendulum engine to a vibratory motion, the inventor states, gives to it a manifest superiority over the ordinary vibrating cylinder, hung upon its centre; the whole tendency of the latter, when put into motion, being to a continuance of it in a circle; whilst the former, obeying the law of gravitation, always tends to a vibratory motion. Mr. Lester, in his description, enters into some estimates founded upon the length of the pendulum which vibrates seconds, (39⅛ inches,) and that of a pendulous cylinder which should vibrate in the same time, intended to exhibit the advantages resulting from this structure. His calculations upon this point are necessarily somewhat vague, as, from the attending circumstances, they do not, in fact, admit of any thing like precision; he observes that "In regard to gravity, the cylinder of the pendulum engine will represent a pendulum of a little less than two-thirds of the length of the cylinder of the engine, so that a pendulum engine, of which the cylinder is four and a half feet in length, will, as far as gravity and oscillation are concerned, represent a pendulum of 30 to 36 inches in length. As such a pendulum vibrates seconds, it follows that an engine of which the cylinder is four feet and a half in length, will perform 30 to 35 revolutions in a minute, without the least disturbance or impediment from its gravity; and an engine, of which the cylinder is twenty-seven inches in length, will perform somewhere about 50 or 60 revolutions a minute, without any obstruction from this cause. To this degree there can be no question that gravity concurs perfectly with the motion of the cylinder of the pendulum engine. But it appears from the facts stated in relation to the engines already in operation, that it may be run at double this velocity at least, to advantage. The engineer of the pendulum engine at the Navy Yard in Charlestown, from observing the action of the engine, estimates that it might be advantageously driven a hundred revolutions a minute. This allows of a greater velocity than that at which a fixed engine can be driven without endangering its gearing."

The difference between a pendulum of 30 inches, and one of 39⅛ inches, is too great to admit of the conclusion that they each vibrate seconds. We speak of this only as a matter of calculation which does not do much towards establishing the point insisted upon; and indeed it is admitted both by Mr. Lester and those who have used his engine, that the rapidity of its action may vary greatly from that of its natural vibration, without any apparent inconvenience; and such we should have anticipated would prove to be the case. Were the fact otherwise, we should view it as a serious disadvantage, as the number of vibrations made in a given time, cannot, in the working of a steam engine, be rendered uniform under the varying circumstances of its application.

"Another advantage in the plan and construction of this engine, remaining to be mentioned, arises from its working in a frame, the parts of which always maintain the same relation to each other, and, as it has in its operation no tendency to displace any fixtures or disturb the foundation, a great expense is saved in these respects, in putting up the engine, more especially in places where it is difficult to get a good foundation. The pendulum engine only requires a foundation sufficient merely to support the *weight*, without any necessity of providing for extraneous resistance to the action of the machine itself, as in the case of a fixed engine."

"On this engine being first put into operation, a query was suggested whether it would have a greater tendency, than a fixed engine, to wear the cylinder ovaling or untrue. I felt great confidence from the first that it would not prove to be liable to this objection, and experience has fully shown, as will appear from the certificates annexed, that with any reasonable skill and care in keeping it packed, it will wear perfectly true, which is not always the case with fixed engines, even with the greatest attention of the engineer. So far, therefore, from there being any objection to it in this respect, it might be enumerated as one of its advantages, that it is less liable to wear the cylinder unequally, than a fixed engine; though there is no doubt that an engine, on this, or any other plan, may wear the cylinder unequally in case of gross negligence in keeping it packed."

"As practical application and use are the true tests of all machinery, I have requested some persons who have been acquainted with the operation of this engine, to make statements of the results of their experience and observation. Their statements are annexed. They are made by persons who have no interest whatever in obtaining for the machine a better reputation than it merits. Some of them are persons of mechanical science, others are practical engineers; and a number of them are sufficiently well known to the public, to insure confidence in their statements and opinions."

We cannot insert the whole of the certificates in consequence of their great length; we therefore make an abstract from them, containing what relates particularly to the action of the engine.

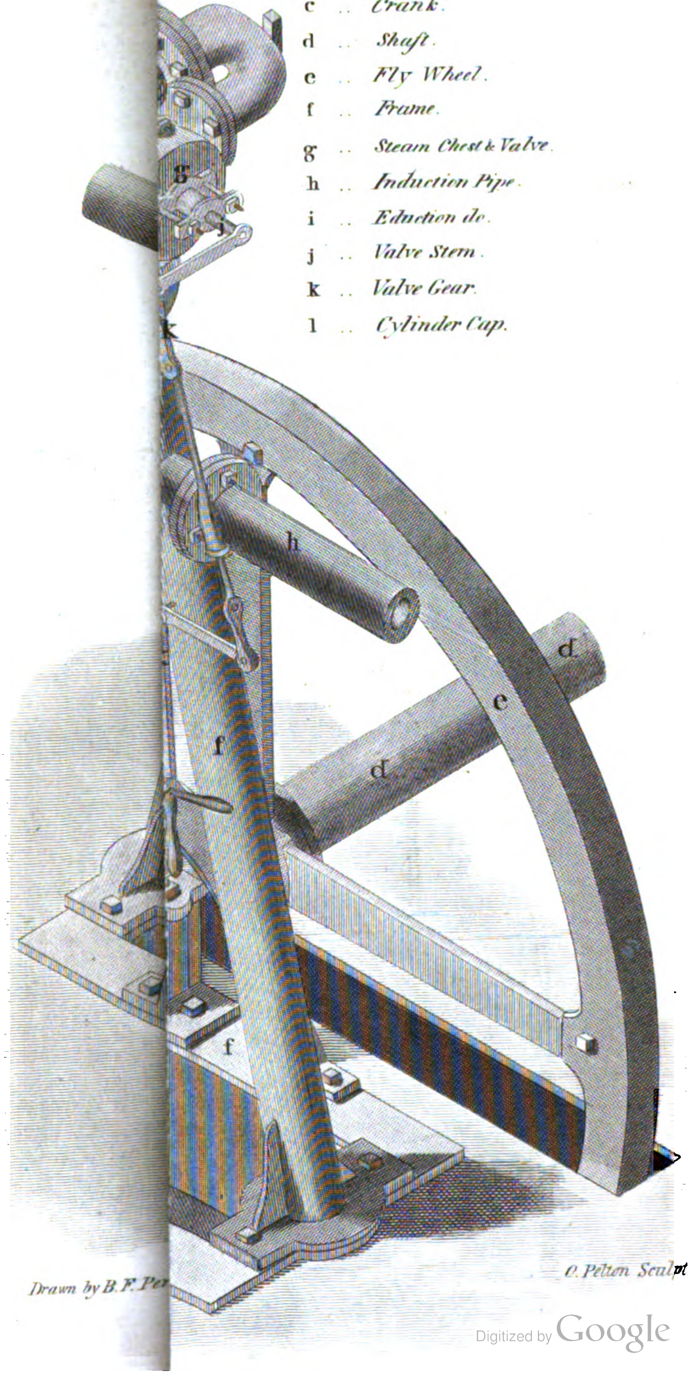
CERTIFICATES.

Noah Butts, Engineer of the Navy Yard, Charlestown, states that one of Mr. Lester's engines had been used by him for two years; that he had found it greatly superior to those on the old plan; requiring packing much less frequently, and keeping in order much longer. That it had no tendency to wear oval. The engine has a nine inch cylinder, and a twenty-eight inch stroke. It has run about 16 hours

L[illegible]STEAM ENGINE

Explanation.

a *The Cylinder.*
b .. *Piston Rod.*
c .. *Crank.*
d .. *Shaft.*
e .. *Fly Wheel.*
f .. *Frame.*
g .. *Steam Chest & Valve.*
h .. *Induction Pipe.*
i .. *Eduction do.*
j .. *Valve Stem.*
k .. *Valve Gear.*
l .. *Cylinder Cap.*



Drawn by B. F. Pe

O. Pelton Sculpt.

per day; at times it has worked six pumps and driven four lathes for turning iron, &c. and two grind stones. Two of the pumps lift a column of about forty feet each, weighing about a ton. The four smaller lift 16 feet, the column of each weiging about 200 lbs. The stroke of the large pumps about 33 inches; those of the smaller 24. The strokes of the pump as compared with those of the engine, are as 7 to 25. The boiler is 18 feet long, and 3 in diameter. The usual pressure from 20 to 30 lbs. per inch.

L. BALDWIN, Esq. Engineer of the Dry Dock, Charlestown Navy Yard, says:—"The engine was first set to work in May, 1828, and has ever since been daily used in pumping water from the foundation of the dock. No part of the machinery has given way, nor has the engine failed to do all the work which was required. It has, in every respect, answered my expectation, and were I to engage in a similar undertaking, I would obtain a similar engine for the same service. Its simplicity and compactness render it peculiarly adapted to constructions like the dock, where a slight and temporary foundation only can be had. I have always viewed its operation with peculiar pleasure, and am convinced that it has been more economical than any other engine of the same power I could have procured. I regret I had not procured one like it for draining the works of the Norfolk Dock in Virginia.

ALEXANDER PARIS, Superintendent of the Dry Dock, certifies to the facts before stated, and to the general excellence of the engine; and a similar certificate is given by eight other persons employed there.

From the Woollen Manufactury of BENJAMIN BUSSEY, Esq., in Dedham, there are several testimonials of its goodness. After a long and fair trial its parts were all in excellent order, and it did not require packing more than three or four times a year.

"*Extract of a letter from the Rev. Enoch Burt, of Manchester, Conn. dated June* 11, 1830.

It is now six months since I have had your pendulum engine in operation. It works well. From a practical as well as scientific acquaintance with the various engines now in use, I, at the first examination, (viz. at the Dry Dock in Charlestown,) pronounced it in my own mind vastly superior to any other plan, and from operating it for six months, (during which time it has never been repacked,) in my manufactory, I am fully confirmed in my opinion of its superiority; it is, you know, only a four and a half inch calibre, 18 inches stroke, and I run it but 35 revolutions per minute: (it would be adviseable to run it much quicker, but this speed is best for my work,) and with steam at about 25 lbs. per inch, it drives my fulling mill, calender, shearing and drying machines, and raises the water for the works by a pump of 4 inch calibre and 9 inches stroke, from a well 25 feet deep. I have run it three days with one cord of 2 feet wood, (oak,) which is sufficient. The simplicity of it is admirable. It exhibits all its parts in operation at a single view. I have no trouble in keeping it tight and in order—and I do not hesitate to say that it will, with a given quantity of steam, produce an effect 20 per cent. greater than can be produced in one of the same size stationary cylinder. This arises from the great diminution of friction, by the direct application of the power to the crank. It runs perfectly smooth—no noise—and with proper attention no way liable to get out of order. Those who want steam power, need only make themselves acquainted with the pendulum engine to give it at once a decided preference to every other kind now in use—for it only wants to be known to be preferred, and this is the engine that is fitted, from its construction, (and the only one,) for rail-roads. I need not wish you great success in introducing it; the intrinsic excellency of the invention must insure it. If my opinion is of any service to you in forwarding its introduction, you are at liberty to make what use of it you think proper.

Yours, &c.

E. Burt."

Mr. E. A. Lester.

The accompanying plate, with the references thereto, exhibit with sufficient clearness, the general structure and arrangement of the engines.

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, June 23, 1831.

Mr. Samuel V. Merrick was appointed chairman, *P. T.* and Mr. Frederick Fraley, Recording Secretary, *P. T.*

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Howell Hopkins, Esq.

The Gentleman and Cabinet Maker's Director, being a collection of the most elegant and useful designs of Household Furniture, 1762.

By Messrs. Carey & Lea.

The nature and properties of the Sugar Cane, with practical directions for the improvement of its culture, and the manufacture of its products, by G. R. Porter.

By Messrs. G. & C. & H. Carvill, New York.

Treatise on the Steam Engine, by James Renwick, LL. D.

A Compendium of Mechanics; or a Text Book for Engineers, Millwrights, &c. by Robert Brunton, with additions by James Renwick, LL. D.

By Mr. R. S. Gilbert.

The Cabinet of Natural History and American Rural Sports, *No.* 6, *vol.* 1*st.*

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

London Journal of Arts and Sciences, for May, 1831.

The Repertory of Patent Inventions, for May.

The Mechanics' Magazine, for April.

The Register of Arts and Journal of Patent Inventions, for May.

The Journal of the Royal Institution of Great Britain, for May.

Recueil Industriel, for January.

Bibliothéque Physico-economique, for March.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for December, 1831.

American Annals of Education and Instruction, for June.

The American Quarterly Review, for June.

The Ladies' Book, for June.

Museum of Foreign Literature, Science, and Arts, for June.

The committee on Inventions presented their reports on the following subjects, viz;

On Mr. Thomas Earle's improved Steam Boiler.

On Mr. Charles Thompson's machine for making Window sashes.

On Mr. Ebenezer Whiting's machine for cutting Bungs for Casks.

Which were read, and on motion referred to the committee on publications, with power to publish.

George W. Smith, Esq. to whom was referred the question—

What is the best unguent, and the most economical mode of its application, to diminish the friction of rail-way cars, locomotive engines, and other machinery of similar construction; stated, that the results of several experiments which have recently been made, have led to the conclusion, that the finest quality of sperm oil most effectually relieves machinery from the effects of friction. As the experiments, above alluded to, were still under consideration, and others about to be tried, to test the correctness of the conclusions already drawn, he requested that the consideration of the question should be named for discussion at a future meeting; and assured the meeting, that as soon as the decision of the final experiments should be known, he would lay the results before the Institute.

Professor A. D. Bache remarked, that Mr. Wood's experiments on the friction in rail-way carriages, had shown the fact to be in that case, as stated by Mr. Smith, and that those of Rennie led to the conclusion, that the nature of the unguent should bear some relation to the weights to be supported, or resistances to be overcome, the more fluid unguents applying best to light loads.

After which Mr. J. M'Ilvaine stated, that in using the various kinds of unguents on his machinery, he had come to the same conclusion as that stated by Mr. S. that the best quality of sperm oil was the most beneficial; having considered it as a question of much importance, he had devoted a considerable time to the subject, and was very particular in making his observations. He further remarked, that the oil should be carefully cleansed, and deprived of those parts which water could remove.

SAMUEL V. MERRICK, *Chairman.*

FREDERICK FRALY, *Recording Secretary, P. T.*

REPORTS

Of the Standing Committee, appointed by the Franklin Institute, to examine the merits of such inventions or improvements as may be submitted to their consideration.

On a Machine for Cutting Bungs for Casks, &c. by Mr. EBENEZER WHITING.

THE committee on inventions, to whom was referred the consideration of Mr. Whiting's bung cutter,

Report, That in the opinion of the committee, the very compact and simple machine of Mr. Whiting is eminently calculated to answer the purpose of its invention. They find that it consists of a shaft six or eight inches long, to be fixed in the mandrel of a lathe. In the other end of the shaft is a pin capable of retreating against a spiral spring, within a cylindrical cavity at its axis. On this shaft, at convenient distances, are two transverse staples, in one of which is a joint of the cutting part of the tool, while the other (nearer the cutting end) serves as a guide to the cutter, in its movement about said joint. The cutting part is kept at a proper distance from the shaft by a spring between the two, admitting, however, sufficient motion to give the conical form to the bung.

From the specimens of its work which accompanies the description, there exists no doubt in the minds of the committee, of the entire adaptation of this machine to its intended purpose, and they feel entire confidence, that brewers, distillers, and others having occasion for a large number of cask bungs, will find their interests promoted by using Mr. Whiting's machine.

On a machine for making Window Sashes, by Mr. CHAS. THOMPSON, *Poughkeepsie, New York.*

THE Committee on inventions to whom was referred the consideration of Mr. Charles Thompson's "Machine for making Window Sashes,".

Report, that the committee have examined with care the models accompanying the specification of this machine, and that they have seen specimens of window sashes stated to have been made by the machine as now in operation on a large scale.

The "machine for making window sashes," as seen in the models before the committee, is in fact a series of no less than eight independent machines, to each of which, motion is communicated by any convenient mover, through bands and pulleys, and thence, when necessary, through cranks, tangent screws, and cog wheels. The operations of sawing off, slitting, cutting tenons, making monions, and dovetails, are all performed by circular saws, furnished with suitable carriages and supports for the stuff on which these several operations are to be effected.

The cutting of grooves is performed by cutters revolving in the manner of circular saws.

The planing, ovoloing and rabbeting, are executed by suitable planes, moving with alternate motion in a convenient frame, in connexion with a fly wheel intended to produce regularity of action.

The mortising and coping are also performed by the alternate vertical motion of chisels, acting on the pieces placed upon supports, or carriages, beneath them.

The boring of holes for all the pins in the completed sash is effected simultaneously by a number of bits, moved by pulleys, connected by a common band, and placed in a frame which serves the additional purpose of pressing up, tightening, and giving the true rectangular figure to the sash.

The committee discover in the several machines an ingenious application of established principles and devices in mechanics, each apparently well suited to discharge the office which the inventor has assigned to it.

The very nature of the work to be performed implies the necessity of various and somewhat complicated machinery; but the committee do not find any part which, in the extensive operations of the machine, could be advantageously dispensed with.

The machine for cutting tenons is furnished with an apparatus for reversing the motion of the endless chain which carries the piece to be cut, and also with an arrangement for varying the speed of said chain. These parts, though not constantly employed, may probably be found useful, the former, to facilitate the removal of a piece whenever, by accident, the saws become clogged, and the latter to accommodate the amount of work to be done in a given time to the state of the saw teeth, and to the thickness and condition of the timber.

The committee feel assured that the machines now exhibited in model, may be found capable, if well constructed in working size, and adequately superintended, of executing a large amount of sashes in a day, and of diminishing the expenses of building, which, in rapidly growing towns and cities, and in newly settled districts of our country, is frequently no inconsiderable obstacle to the progress of improvement.

The work presented from the manufactory at Poughkeepsie was free from blemishes, and highly satisfactory in point of stability.

The committee can cheerfully recommend this machine to the attention of builders.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *washing Gold Ore,* and alluvial auriferous earth; John Powell, Salisbury, Rowan county, North Carolina, April 1. Granted in pursuance of a special act of Congress, passed February 12th, 1831; the applicant not having resided two years in the United States.

The washing in this machine is to be performed in a large shallow bowl, which is best formed of cast iron. For ordinary machines this bowl may be three feet in diameter, and one foot in depth. The inside is to be turned perfectly smooth, and at the bottom of it a cup-like cavity is to be turned, which may be three inches in diameter, and half an inch in depth. This bowl is to be placed on a vertical shaft, and is to receive a rotary motion, by means of a crank, and bevel gears. The ore, or earth, to be washed, is placed in the bowl, to which water is supplied in any convenient manner. When caused to rotate, the centrifugal force will throw the water, with the stones and light earthy matter, over the edge of the bowl, whence they fall upon an inclined plane, and are conducted off. The gold, with the heavier species of sand, and particles of plumbago, collect, from their superior specific gravity, in, or near, the cup at the bottom of the bowl. Mercury is sometimes to be used for the purpose of amalgamating the finer particles.

Some rakes and scoops are described, which are necessary auxiliaries in the process of washing.

The whole machine is considered as new, no claim being made to any of its particular parts, or to their arrangement.

---

2. For an improvement in the *Thrashing Machine;* Gideon Cande, and Joseph Tousey, Rochester, Monroe county, New York, April 1.

The beaters consist of iron bars let into grooves, or spaces in a cylinder, and extending from end to end. The hollow segment consists of bars each fixed in separate slots in end pieces, and borne up to their places by means of spiral springs.

The claims are to "the manner in which the iron bars, or beaters, are constructed and attached to the convex cylinder; and the manner in which the ends of the bars in the concave cylinders are fixed, so that each iron bar may recede, as grain or other objects which enter the machine make it necessary.

---

3. For a machine for *making Wood Screws;* Hazard Knowles, Colchester, New London county, Connecticut, April 1.

A machine to manufacture wood screws, is, of necessity, one of considerable complexity, as is evinced by all the machines for this purpose which have been patented both here and in England. In the present instance the specification and references to the drawings occupy nearly thirty pages of foolscap paper; the description has evidently been given with great care. There is no claim made, which is to be regretted, as there must necessarily be some parts common to this and other machines for the same purpose. We do not think it necessary to attempt an explanation of the structure of that now patented.

---

4. For *applying the Circular Saw to the cutting of Laths;* Chaning Madison, Miamiesburg, Montgomery county, Ohio, April 4.

The patentee says, "My claim to the invention of this lath machine, consists in the application of the circular saw to the cutting of lath off slabs at saw mills, as before mentioned."

We are very apprehensive that a claim to the application of the circular saw to the cutting of laths, would not be tenable, even if the thing had never been done, as the saw has been long in use for sawing strips in general; but its particular application to the sawing of laths has been before patented. There must, therefore, be some novelty in the construction of the machine upon which to found a valid claim.

---

5. For *improvements in Metallurgical operations* for accelerating and improving the manipulations in general, with the use of anthracite coal in particular; Richard Wilcox, Patterson, Essex county, New Jersey, April 6.

This is the first of a series of three patents, all tending to the same end, as being parts of a general system for the reduction of metallic ores, and particularly that of iron.

The second patent has the following title.

---

6. For *improvements in Metallurgical operations*, by the introduction and adoption of chemical agents which prevent the ores from oxidating, or volatilizing, either from a redundancy of caloric evolved during the fluxing of the ores, or the deleterious action of the gases, either in blast, reverberatory, or cupola furnaces or forges, &c. Together with further improvements in divers sorts of furnaces, cupolas, &c., April 5.

The third patent is—

---

7. For *improvements in Metallurgical operations*, in the manipulation of metals in general, with bituminous coal, charcoal, coke, wood, peat, &c. April 5.

The series occupy forty well filled pages, and furnish an essay on metallurgical operations, rather than a mere detail of the improvements claimed, and such other matter as might be necessary to render the nature of these improvements clear and intelligible. The drawings contain 21 separate representations of furnaces in section. To give an analysis of these patents would demand more time and space than we can afford. In the first there are six leading improvements claimed. *First.* The concentration of heat, by the construction of the furnaces, as exemplified in the drawings. *Second.* Separating the ore from the coal, or any other combustible matter, and preserving them separate from each other during the manipulations. *Third.* Separating the metals in a lower or secondary reverberatory furnace, or furnaces, sometimes preserved at a regular and uniform temperature by additional fires. *Fourth.* Employing in this system not merely anthracite, but other kinds of fuel, and using not reverberatory only, but other kinds of furnaces. *Fifth.* Dispensing with the large quantity of oxygen gas which is usually forced into furnaces when the ore is in fusion. *Sixth.* The reducing the iron to a malleable state at one operation without exposing the cast iron to the injurious effects of the oxygen contained in the atmosphere.

The second specification describes the modes in which a combination of sand and clay is to be used in the furnaces, which mixture is to form a covering, or flux, to protect the ore and the fused metal from oxidation, volatilization, &c. and likewise the structure of the furnaces used by the patentee; the principle upon which these are constructed, it is stated, may admit of numerous modifications: the general principles, or modes of operation, however they may be modified, are claimed as the objects of the patent.

The third specification principally points out modifications in the manipulations, and furnaces, adapting them to the use of fuel other than anthracite.

The intelligence displayed in the general contents of these specifications inspires a belief in the value of the system adopted. This is no place for a critique upon the theoretical parts of the instruments before us, many of which, although they evince some acquaintance with chemistry, are very far from being invulnerable. If the processes are good, these mistakes are of little practical importance, and we name them principally for the purpose of stating that a specification of an invention, or discovery, is not an instrument of reasoning, but of description merely; that its object is to inform us how, rather than why, a particular thing is done. There are but few of those specifications which extend to twenty or thirty pages, as many do, which might not present every thing that is new, and requisite, in less than one-fourth of the space, and with more advantage to the public. We are fully aware that the aim of those who draw them up at such length, is to give in full detail every thing which appears to them to bear upon the subject, and that although unnecessarily long, the motive for making them so is praiseworthy.

8. For a *Washing Machine;* Miller D. Mulford, Bloomfield, Ontario county, New York, April 5.

This is a box, or trough, hung upon gudgeons, and which is to be rocked by hand. Notwithstanding the magnificence of this invention, there is no claim made to any part of it.

---

9. For a *machine for Thrashing and Cleaning Wheat* and other grain; Samuel Lane, Hallowell Kennebeck county, Maine, April 6.

(See specification at p. 270. vol. vii.)

---

10. For an improvement in *Fuel for manufacturing Malleable Cast Iron;* Seth Boyden, Newark, Essex county, New Jersey, April 6.

"The improvement consists in applying peat, or turf, as a substitute for bituminous coal, in manufacturing malleable cast iron, as described in a patent granted to me the 9th day of March, 1831. The improved fuel, or composition of peat and rosin, pitch, or tar, is free from the injurious effect of the sulphur contained in the bituminous coal. SETH BOYDEN."

We have, as in the specification referred to, given the whole of the matter contained in the description of the patentee.

---

11. For *Glass Frames for Pictures, Looking Glasses, &c.;* John Scott, Philadelphia, Pennsylvania, April 6.

This patent is taken for a frame made of glass, whatever its form may be, and whether made in one or more pieces. Some century since, it was the common fashion to make looking glass frames out of glass variously cut, and ornamented. We are compelled, therefore, to place this patent among the *modern antiques,* where it will find many companions.

We have no doubt that the patentee prepares his frames in better taste than those made by our great grandfathers, and had his claim been confined to any new and improved method of construction, it might have been good; at present it is certainly too broad.

The drawing is without written references.

---

12. For an improvement in the *method of Washing Rags in the manufacture of Paper;* John Ames, Springfield, Hampden county, Massachusetts, April 6.

(See specification.)

---

13. For an improvement in the *Scoop Shovel;* Elisha Mudge and Rufus Tenny, Alexander, Genessee county, New York, April 6.

A piece of plank is taken which forms the back end of the scoop; a piece of sheet iron forms the bottom and sides of the shovel, and is to be nailed on to the edges of the plank. A handle, 2 feet 3 inches long, is to be attached to the plank, and properly secured and braced. This constitutes the whole of the *conjoint invention* of the patentees. There is no claim, and no references to the drawing.

---

14. For an *apparatus for preventing the Bursting, Collapsing, or Burning of Steam Boilers;* William A. Turner, Washington county, North Carolina, April 6.

This specification describes modes of operation analogous to those contained in the patent obtained on the 15th of last month, by the same gentleman. There is to be a door or shutter, which may be placed in the top of the boiler, which is to open upon hinges, instead of working in slides. By the intervention of several levers, this door is connected with the safety valve, and when the valve rises, this door, or shutter, is liberated, and is to open and allow the steam to discharge readily. A damper is at the same time to close the draft of the furnace, and streams of water are to pour upon the fire. Besides this, there is to be a fusible metal piece attached to the lower side of the boiler, and when this melts, a weight causes a rod to ascend, which passes through a stuffing box in the top of the boiler, when effects are to ensue similar to those produced by the rising of the safety valve. The array of catches, levers, and other appendages is equal, if not superior, to that of the former patent. If the safety of boilers cannot be established without the addition of numerous parts, every one of which is liable to derangement, we must make up our minds to run the risk of explosions. The effects of temerity, ignorance, and avarice, will not be prevented by such means. The present patentee has evidently been at much pains to attain the end desired, but we are convinced that his plans, if essayed, would prove to be entire failures.

There are no claims made in either of his patents.

---

15. For *Making Coke from Anthracite Coal,* for smelting ores, and for the preparation of steel; Moses Isaacs, Philadelphia, Pennsylvania, April 7.

The patentee informs us, that to convert anthracite into coke, he piles it up in the form of an arch, or cone, leaving space for the combustibles, and to heat it sufficiently; for this he uses wood, rosin, pitch, tar, or any similar substance; he places one or other of these under the anthracite, and kindles it, "to expel the vapour, foul air, dampness, &c. it renders porous, I throw on a quantity of water and flour, or water and lime mixed, or a quantity of glue, clay, or any other earthy or other substance which will dissolve in water, and stiffen or harden by being exposed to heat or air, for the purpose of cementing it together, which cools, and leaves it united, or coked, free from receiving foul air, dampness," &c.

We know something about anthracite, coke, and other kinds of fuel, but not enough to appreciate the value of the present discovery; to those whose understandings are less obtruse, we therefore commit the investigation.

The patentee, it appears, is not a citizen. He has not, however, taken the oath which the patent law prescribes to aliens.

---

16. For a *Metronome, called "The Accenting Metronome,"* to be used in teaching music; Uri Emmons, city of New York, April 7.

Those skilled in music, know that the ingenious Mr. Maelzel invented an instrument for beating time in music, which he called a *Metronome.* The beats were made by a pendulum, and the time changed by moving a sliding weight upon its rod. Mr. Emmons, instead of a pendulum, uses a fly, the wings of which are adjustable, as they can be made to approach to, or recede from each other, and thus alter the time of their gyration.

The instrument is to be wound up like a time piece, it having a barrel, and weight, connected with the movement necessary to act upon the fly. The time is counted by hammers striking upon a bell, which bell may be muffled by a piece of leather interposed between it and the hammers.

The claims are to "the simple form and construction of the above described machinery; especially that of dividing the time on the degrees of the wheel, and of arranging and lifting so as to produce the changes, and both common and treble time, with all the accents according to the different moods, together with the construction and application of the fly and index, by which the different motions are marked and regulated."

---

17. For a *Vessel for boiling Liquids of all kinds;* Richard M. Beach, Franklin, Delaware county, New York, April 7.

This vessel is a wooden trough with a bottom of sheet metal; it is to be set in brick work, so that the fire applied may come in contact with the bottom only.

Wooden boilers, with metal bottoms, have frequently been made, and are applied to various purposes.

---

18. For *manufacturing Spades and Shovels* by means of machinery; Charles Richmond and Samuel Caswell, Jr., Taunton, Bristol county, Massachusetts, April 7.

(See specification.)

---

19. For an "*Inclined Plane Friction Roller Press;*" Luther Carman, Oxford, Oxford county, Maine, April 7.

(See specification.)

---

20. For an improvement in the *art of Churning;* Elias V. Coe, Warwick, Orange county, New York, April 7.

"The following is a full and exact description of the art or manner of churning as invented or applied by me; which consists in the application or forcing air into milk or cream, by means of an air or forcing pump, bellows, or other like machinery or instruments, propelled by hand, water, weight, steam, wind, animal, or any other power. ELIAS V. COE."

The foregoing brief, but emphatic, lines, constitute the whole of the specification. There, however, is a drawing accompanying it, with copious references, in which a jack is represented, which is to be driven by a weight of 300 pounds; this weight, through the intervention of the requisite wheel work, a part of which is "a wheel of three feet diameter, with 120 teeth," works two pair of small bellows which blow their wind through a leather tube into the barrel of cream. The whole appears to us rather airy, notwithstanding the great weight employed.

---

21. For a *Mould for making Scythe Sneaths;* John Knight, Woodbury, Gloucester county, New Jersey, April 8.

A mould is to be made for the purpose of bending the timber into the desired curvature, and as the sneath is usually bent in two ways, the mould must be formed accordingly. This is to be effected by marking the intended curvature in one direction upon a piece of timber of sufficient thickness, which may then be sawed through in the line of the curve. Upon the edge of one of these pieces a furrow, or groove, is to be made, having the curvature in the other direction; the furrow must be of such size as to allow the sneath to pass into it. When these two pieces are put together, they form the mould. The timber worked straight, and to the proper size, is to be softened by steam, driven endwise into this mould, and allowed to remain until it has obtained its proper set.

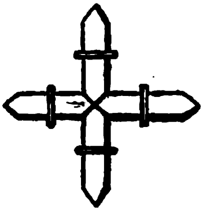
There is no claim made, but as the bending by steam is a common process, and not, therefore, the subject for a patent, the particular manner of making the moulds must be the thing intended to be patented; this we believe to be new, and it may consequently be legitimately claimed.

---

22. For a *Machine for making Horse Shoes;* David Anthony, Jr., Adams, Berkshire county, Massachusetts, April 8.

The horse shoe is to be formed by means of wheels, or rollers, of which there are to be four; they are to be made narrow upon their faces. These rollers have axes, the gudgeons of which run in a strong iron frame, in the centre of which their faces meet; they stand opposite to each other, in pairs, so that a section through their axes would form a +. They are geared together by bevel wheels, and all turn simultaneously. Their edges are bevelled, to bring them in contact, and their faces are so formed that a bar of iron passed between them will assume the shape required, and be countersunk, so that when bent round, the horse shoe will be in a nearly finished state. The wheels may be of such circumference as to form three shoes at one revolution. From these rollers the iron passes on to an apparatus for bending it round in the required curve. The claim is to "the machine for making horse shoes as above described."

We have no doubt that a machine of the foregoing kind, if made with great precision, will give to the iron the shape desired, but as regards the validity of the claim, the same circumstance which interferes with many *new inventions*, stands in the way of this; it unfortunately is old. A machine of this description was first brought into use in England, and was eventually imported into France. Of the period of its invention we are not informed, but in the *Recueil Industriel*, for December, 1828, published in Paris, a description and plate of this instrument may be found. It is there denominated "a machine which is to give to iron all the different forms required in the arts, by means of a continuous rotary motion." The French account remarks that by an engine of eight horse power, operating upon a machine of the size designated, 3,000 nails of an inch in length, might be manufactured in a minute; and that by its aid iron may be converted into any desired form in a very rapid and exact manner.



A comparison of the patent before us, and of the accompanying drawing, with the description and engraving in the above journal, will remove all doubt with regard to the perfect identity of the two machines.

The opposite sketch will afford some idea of the manner in which the wheels, or rollers, run together. Were their angular points taken off, a square bar might be formed by passing the metal between them; and other desired shapes, it is evident, might be produced, by indentations of the proper form.

---

23. For *applying steam for blowing Fire;* Joel Eastman, Bath, Grafton county, Maine, April 8.

This patent is for applying an aelopile to the blowing of a forge fire. A strong cylindrical boiler is to be made, capable of containing two quarts of water. This is placed so that it may receive the heat of the fire, and, when necessary, some ignited coals are to be put under it; from the top of this boiler, a tube descends and terminates in the mouth of another tube which forms the tuyere. The opening in the steam tube is to be from one thirteenth to one sixteenth of an inch in diameter, whilst the tuyere tube is to be two inches in diameter at the outer end, and about one where it enters the fire. The claim is to "the application of steam to the blowing of fire as above described."

There is nothing new in the principle employed, or in its application. In the older, as well as the more modern books of philosophy, the principle is explained, and its application shown. It is not, in fact, the steam which feeds the fire, but, as this rushes forward it carries with it a considerable volume of atmospheric air, which produces the combustion. If an ignited coal be placed close to the steam tube, it will be extinguished; if at a distance, its combustion will be promoted.

In practice the plan will not be found to answer any good purpose, as the blast cannot be sustained and regulated, as with the common bellows. The contrivance is to be considered as a philosophical toy, rather than a thing of practical utility.

---

24. For a *Thrashing Machine;* Wm. B. Marks, Petersburg, Dinwiddie county, Virginia, April 8.

"What I claim as my invention is the reversed twisted bars on the cylinder, and concave bed, and their position as described in each, and also the twisted rods, or bars, and their oblique position as placed and described on the under feeding roller." So ends the specification.

If we could find any novelty in this arrangement, it would be some relief to point it out, as we are really tired with the almost perpetual repetition of the same opinion, that "there is nothing new." It might save trouble to our printer were he to get these words stereotyped.

---

25. For an improvement in *Mills;* being a mode of using the tread wheel, by combining its power with that of the tub wheel; Elias Davis, Bangor, Penobscot county, Maine, April 9.

The patentee claims as his invention or discovery, the *new principle* contained in his description of his mill. This new principle is to enable "a given power, (horse power,) applied to the tread wheel, to produce double the momentum that it has ever before been found capable of producing."

What the new principle is we have not been able to discover, as we see nothing more than a tub wheel on a vertical shaft, which is to aid and be aided by a horse wheel, the power of the two being conveyed to mill stones through the intermedium of a number of cog wheels, regulated by the momentum of fly wheels. There are altogether 9 or 10 wheels, which, we suppose, are, by their mode of combination, to produce the double effect claimed.

---

26. For a *Cylinder Corn Shelling Machine;* Jabez Parker and Hiram M. Smith, Richmond, Virginia, April 9.

This shelling machine has a cylinder with ribs of iron set spirally operating round it, like the teeth in the original corn sheller. The alterations, or improvements, upon which the patentees rely, is the increasing the velocity of the cylinder three fold, by gearing, which, whilst it reverses the motion of the cylinder, enables the operator to turn the crank with his right hand, and feed the hopper with his left. The manner of fixing the springs to adapt it to ears of different sizes. The bending of the iron ribs in such a way as to throw the cobs from the machine, and the "making the frame in an easy, simple, triangular form, thereby making it a firm, substantial brace to itself." We are assured that "by those improvements the machine is made for about the same expense as the former kind; is more substantial and durable, and less liable to get out of order, is easier managed, will do the work better, and about three times as fast, with only half the labour." A gain of sixfold is a great gain, but notwithstanding this assurance we apprehend that it will be hard work even to feed with three times the ordinary speed.

27. For *Propelling Boats, Mills, Cars on Rail-roads, &c.*, by the means of a lever purchase, operated upon by cranks; Aaron Parkhurst and Silas Bacon, Scriba, Oswego county, New York, April 11.

We have here a train of wheels, cranks, levers, ropes, and pitmen; to be set in motion by the power of two men by the means of handles or levers, which are fastened to the wheels, one to each. Or there may be steam applied to a third wheel, by adding two-cranks, &c. "or with water power on a wheel with the cranks." To this apparatus, which is at war with the horn book of mechanics, there is no claim; we do not apprehend, however, that the omission will be productive of any inconvenience to the patentees.

28. For a new and useful *mode of rendering a variety of articles water proof*, by means of fluid caoutchouc; George H. Richards, city of Washington, D. C., April 11.

(See specification.)

29. For a *Machine for mixing Clay or Mortar;* Aaron Parkhurst, Scriba, Oswego county, New York, April 11.

A circular trough, of the kind frequently used for mixing clay, is to stand upon a platform elevated for the purpose. Horses walking upon this platform turn a horizontal shaft, which carries a *mixing wheel.* The mixing wheel stands immediately above the circular trough, and from the lower side of its spokes iron spikes project downwards into the trough, these are to work the clay, or mortar. When mixed, a slide is removed, which allows the material to fall through into a receiver below the platform.

The part claimed is not designated.

30. For a *Machine for Washing and Churning;* John White, South Union, Logan county, Kentucky, April 12.

The body of this machine is a tub in the form of a common pickling tub; that is made larger at one end than at the other; slats of wood run from end to end on the inside, and the tub has gudgeons on the centre of each head by which it may be hung horizontally. There is a door for the admission of the articles to be operated upon.

When clothes are to be washed, the machine is to receive 20 or 30 turns in one direction, and then an equal number in the other, and so on alternately. In consequence of the conical form of the tub, the revolution of the barrel, causes the clothes to twist up; the reversed motion twists them in the contrary direction, and this alternate twisting is said to clean them thoroughly without injury. Its operation as a churn needs no explanation.

The claim is to "the so forming the tub, that in washing, the clothes shall be alternately twisted and untwisted, in the manner above described, with the slats contained therein; and also the application of a similar tub to the purpose of churning."

---

31. For a *Smut Machine,* for cleaning grain; Levi Hayward, Phelps, Ontario county, New York, April 12.

The grain to be cleaned is dropped from a hopper into a hollow cylinder of sheet iron, standing horizontally, a large portion of the inside of this cylinder is set with spikes. A fan, with four wings, is made to revolve in this cylinder, with a speed of seven hundred times in a minute; this is to throw the grain and smut against the spikes, which operation cleans the grain, and pulverizes the smut. From the cylinder the grain passes off into the eye of the stone, and in its passage the smut is blown from it by means of a fan wheel.

---

32. For an improvement in the *Water Wheel;* Martin Coney, Portland, Chataqua county, New York, April 12.

This is the often proposed plan of a strap, or endless chain, passing round drums, with buckets attached, to be operated upon by the water; there are no details setting forth any improvements, the whole description being general and imperfect.

---

33. For a *Machine for Breaking Stone* for turnpiking and other purposes; Benjamin F. Lodge and Ezekiel T. Cox, Zanesville, Muskingum county, Ohio, April 12.

A cast iron bed piece is to be provided, upon which the stone to be broken is placed. This bed piece may be about a foot in diameter, is to be concave on its upper surface, and perforated with holes for the broken stone to pass through. A ram or hammer is to slide between cheeks, or to be hung like a tilt hammer, for the purpose of breaking. The face of this hammer is to be furnished with projecting pieces, adapted to the holes, and suited to the concavity of the bed. Any of the known motive powers may be used to work the hammer.

"What we claim principally as new and useful, is the form of the bed, or block, and hammer; that is, the concavity of the one, and the convexity of the other; for we are aware that there has been an attempt made to introduce cast iron plates, or blocks, with holes for the purpose of breaking stone as above; but having a level surface, and being worked by a common sledge, or hand hammer, they have been abandoned as useless. The stone having a bearing upon the plate or block, directly under where the blow was applied, it resisted the force of the blow, and the blow produced little or no effect, and the pieces of stone broken off were liable to fly in any direction;

whereas our machine, having a concavity in the block, or bed, the stone has no bearing in the centre; and the hammer, of corresponding convexity, strikes first in the centre; the consequence is, that the stone is broken into a number of pieces the first blow, and the hammer being as wide as the bed, or block, prevents the stone from flying."

A machine for breaking stone, patented by Messrs. Bell and Andrews, is noticed at page 294 of vol. 6. In that, hammers, hung like trip hammers, are to be used, and the stone broken by them upon iron bars.

Machines for breaking stone are used in England, and are in some cases operated upon by steam; we have not met with any description of their precise construction. We could urge several objections to each of the machines patented here, and believe that the patenting them has not resulted from an experience of their practical utility; perhaps, however, when put into operation, they may serve as the foundation of good instruments. It is not to be expected that any machine, excepting it be one of the most simple kind, will fulfil the anticipations of its projector, without undergoing various modifications suggested by actual trial.

---

34. For a *process by which the Mineral Water of Congress Spring, at Saratoga, may be imitated;* William Meade, M. D. Newburg, Orange county, New York, April 12.

The receipt given is as follows—

1st. Take of tartaric acid, perfectly free from sulphuric acid; dry it in a very moderate heat, and then grind one ounce of it into a fine powder.

2nd. Take super carbonate of soda one ounce and a half, after it has been dried sufficiently to deprive it of its water of crystallization, and pulverize it.

3d. Take muriate of soda half an ounce, after it has been dried in a moderate heat, to deprive it of the whole of its water of crystallization, without decomposing it, and as much depends on the purity of this salt, it will be necessary to attend to the following particulars; it must be entirely deprived of muriate of lime and magnesia, which are generally combined with all species of common salt. They should be got rid of by pouring on the salt a sufficient quantity of alcohol of as high specific gravity as 826; this will take up the deliquescent salts, and leave the muriate of soda untouched; it must then be passed through a filter, and the muriate of soda made perfectly dry, after which it should be finely powdered, and one-half ounce of it carefully weighed.

4th. Take a small quantity of crystallized green vitriol, or sulphate of iron, expose it until it has fallen into a dry white powder. This must be added to the above powders in the following manner.

To one ounce and a half of the carbonate of soda, add two grains of the sulphate of iron, triturate them together; then add by degrees half an ounce of the prepared muriate of soda, then one ounce of the tartaric acid, and triturate the whole until they are intimately mixed.

This powder is to be put into a perfectly dry bottle, to be kept closely corked, and when wanted for use, a small teaspoonful of it put into a tumbler, which is to be immediately filled with cold water, stirred, and drank, whilst in a state of effervescence.

We presume that Dr. Meade may sustain his claim to the precise mode of imitating the Congress Spring water, described by him; but certainly he cannot prevent any other person from combining together the ingredients which have been detected in it by analysis. That skilful chemist, Mr. G. W. Carpenter, of Philadelphia, has, for two or three years past, supplied the public with *Saratoga Powders for making Congress Spring Water.* These powders are noticed in the 16th volume of Silliman's Journal, p. 396. We are not informed of Mr. Carpenter's mode of preparing them, but he has made analysis his guide, and it is averred that they contain "all the essential substances with which these celebrated springs are impregnated, and from which the waters of the Congress Spring at Saratoga are precisely and effectually imitated."

A more simple process than the use of alcohol, will remove the muriates of lime and magnesia from common salt. All that is necessary is to pass through it a heated solution of itself in water; the water will dissolve the deliquescent salts, and deposite its own muriate of soda.

There is no *water of crystallization* in muriate of soda, although a minute portion is entangled among its crystals. There is no danger of *decomposing it*, in the drying, as heat alone will not produce this effect. The precaution given is therefore unnecessary.

---

35. For a *Machine for Shelling Corn;* Joel Barnes and Nelson T. Loomis, Cornwall, Litchfield county, Connecticut, April 13.

A solid cylinder of wood is to have iron teeth driven into it, as in the original shelling machine. A hollow curve is to be adapted to this cylinder, between which two parts the corn is to be shelled. Particular directions are given respecting the manner of forming this curve, which particular mode, or modes, constitute the essence of this invention, the claim being to "the construction and operation of the curves."

---

36. For a *Thrashing Machine;* Newton C. Munroe, Windham, Green county, New York, April 14.

We are told that the improvements in the thrashing machine here patented, "consist in the arrangement and form of the teeth in the cylinder and concave; the method of making and regulating the concave to adapt the machine to thrashing different kinds of grain, and in the mode of gearing, and applying power to drive the machine."

The teeth of the cylinder are to be made of No. 2 wire, and to extend out one and an eighth inch. The teeth are to be in rows, the tooth of one row standing opposite to the space in the next row. One-half the rows of teeth stand straight out, forming radii from the centre, the other half are to be curved forward. The teeth of the hollow segment are of the same kind with those of the cylinder, but are all to curve forward, towards the point at which the grain is delivered.

The machine is to be driven by a horse, attached to a sweep turning a vertical shaft, with the gearing necessary to give the cylinder the proper velocity.

---

37. For a *Wheel for Propelling Boats*, being an improvement upon Antrim and Bolton's water wheel; Phineas Palmiter, Jr., Jamestown, Chataque county, New York, April 14.

A general description is first given of Antrim and Bolton's wheel, which description will answer very well for several different propelling wheels that have been patented, and which are intended to have their buckets kept in a vertical position. Those familiar with the subject are aware that this is in general effected by two wheels running eccentrically, and so connected as to produce the intended effect. We have not sought out the date of Antrim and Bolton's patent, not deeming this a point of any importance. We have noticed numerous wheels having the same object in view, but have never expressed an opinion favourable to any one of them, although we have several times been called to admire the ingenuity displayed in their construction. The present patent is taken for a new modification of the same principle; it has the merit of greater simplicity than most of those which have preceded it, but still we think that it will not be found equal to the simple wheel commonly used. This opinion is justified by the trials that have been made with similar wheels, which, upon fair and long continued experiments, have not been found to give an increased velocity. They must, however, excel greatly in this particular, or they will never be brought into use, as they are much more costly and liable to derangement than the old paddle wheels.

---

38. For a *method of Generating Gas, and of supplying and continuing Gas Light* out of oil or other suitable substance, by means of the gas light itself, in lamps, or machines, either fixed or moveable; Solomon Andrews, M. D., Perth Amboy, Middlesex county, New Jersey, April 15.

(A description of this, and of an auxiliary patent since obtained by Dr. Andrews, will be given in the next number.)

---

39. For a *Machine for Jointing Staves for Barrels;* George Eby, Clarence, Erie county, New York, April 15.

There are two jointers, each furnished with two plane irons, fixed by wedges in the ordinary way, but standing in opposite directions, so that they may joint a stave passing either backward or forward. These jointers are connected together by straps of iron united by pins, which pass through holes at a distance from the jointing part of the planes, equal to that of the semi-diameter of the barrel to be formed; the faces of the planes standing in the direction of radii from these pins as centres. By means of a treadle, the faces of the jointers are made to approach each other, and joint the two sides of a stave at the same time; giving the correct bevel to the edge, whatever may be the width of the stave.

The stave is attached by suitable fixtures to a jointing bar, which is made to pass backward and forward, carrying the stave between the jointers, and tilting it so as to bring it alternately in contact with the irons at each end, in order to give it the required taper.

The claim is to the manner of fixing and working the jointers; the jointing bar; working and tilting as described; and the general arrangement of the machinery for producing the intended effect.

---

40. For an improvement in the manner of *constructing Ships and vessels of every description,* either for the purposes of war or commerce; R. Deming, city of New York, April 15.

(See specification.)

---

41. For manufacturing *Wooden Ware without Staves;* John Patridge, Zanesville, Muskingum county, Ohio, April 16.

Tubs and buckets of various kinds have long since been made by turning the rims out of a block of wood, and afterwards fixing the bottoms in them. On examining the specification of the present patent we are not aware that it presents any important improvement; the patentee lays claim, however, to "the manner of fixing the block in the lathe; the application of a gauge gouge and croes at each end of the rim; the saving operation of labour, and saving of timber; the gauge gouge and croes, [tools for cutting the groove,] to receive the bottom."

---

42. For *Apparatus for communicating Power to Machinery;* Samuel Kilburn, Sterling, Worcester county, Massachusetts, April 16.

The power with which this machine is to operate is derived from the weight of an iron ball, or other heavy body, attached to a shaft by a swiveling joint. By means of a crank the shaft to which the ball is attached is made to revolve; the ball, in revolving, acts upon two treadles, depressing them alternately. The power which is thus to be *generated,* is to be communicated to machinery by cranks and shackle bars, or other connecting parts.

The claim is to the making of the ball, or other heavy body, operate upon treadles as above described, so as by its gravity to concur with them in their descent.

Some ingenuity is manifested in the arrangement of the parts, although it is unfortunately expended in the construction of a machine to *absorb* and *extinguish* power.

43. For an improvement in the *art of Teaching Arithmetic;* Oliver A. Shaw, city of Richmond, Henrico county, Virginia, April 16.

It is proposed to make blocks of wood, or other material of different sizes, in regular progression, or bearing a certain ratio to each other, and by the arrangement, or alternation of place in these, to give sensible solutions not only of the cardinal rules, but also in decimal and vulgar fractions. The claim is to "the mode of teaching arithmetic as above described."

We have not only prepared blocks of wood upon the principles described, but have divided them into squares upon their surfaces, in order to illustrate both their relative proportions, and also the involution and evolution of numbers; but when we did this, we had not the most remote idea that we were establishing any claim to invention, or discovery, and have no doubt that at the period to which we allude, some thirty years since, the plan was then older than "auld lang syne."

---

44. For an improvement in the *Marine Railway,* called by the patentees "an improvement in the art of moving vessels or other heavy bodies on rollers;" Richard P. Joralmon, and Isaac Lockman, Northfield, Richmond county, New York, April 16.

The improvement here claimed consists in the use of rollers of a certain description, to serve as guides, as well as to diminish the friction in raising vessels up an inclined plane. The following extracts from the specification will afford a good idea of the plan.

"There are two streaks of timber, commonly called ground ways, about one hundred and fifty feet long, ten feet apart, lying parallel with each other, extending from the shore into the water, on an inclined plane, firmly fastened down, which have a surface of thirteen inches wide, on which are fastened two streaks of bar iron, running the whole length of the ways; these bars are placed four inches apart; there are rollers of cast iron, thirteen inches long, four inches in diameter, with a gudgeon on each end of two inches diameter; the rollers in the middle, for three and a half inches in length, are five inches in diameter, forming nearly a square shoulder at each end of the thick part of the rollers. These rollers are put in frames made of plank two and a half inches thick and nine inches wide, the plank being fastened together with pieces of wood, and cross braced to prevent them from racking; the rollers are placed in these frames at the distance of three feet apart; the gudgeons being in boxes of cast iron which are let into the plank. The rollers thus arranged, are laid upon the ground ways, and the swell or shoulder of the thick, or middle, part of the rollers, playing between the bars of iron on the ground ways."

The claim is not confined to the materials or dimensions given, and it is observed that the plan is equally applicable to inclined planes for canals, and also to the removing of heavy bodies in other situations.

45. For a *Pump for Raising Water or Air;* Jedediah Beckwith, Saratoga, Saratoga county, New York, April 16.

"The machine is a flat, water or air tight, circular box of iron or other metal, or sufficient material, of any required dimension or capacity, made stationary, and a valved wheel of like metal or material, revolving within the box by any power applied to a shaft or axle running through the outside plates, and upon which the wheel is suspended, with two holes through the rim of the box, one to admit the water or air into the machine, and the other to discharge it."

The remainder of the description consists of references to the drawing, which represents a well known rotary pump, made like many of the rotary steam engines which have been devised. The inside cylinder carries four hinged valves, which fill the annulus in which the water, or air, is to be contained, and close as they pass a metallic projection between the receiving and the discharging pipes. He must be a very good workman who makes such a pump *air tight;* and after he has done so, although his pump will certainly be distinguished by the skill it displays, there will be no novelty in its construction.

There is no claim made.

---

46. For a *Rotary Steam Engine;* Abel Greenleaf, Paris, Oneida county, New York, April 16.

The greater number of rotary steam engines which have been devised, differ from each other principally in the construction of, and in the manner of opening and closing the valves, and such is the case in the present instance. The description refers throughout to the drawing which accompanies it. The claim is in the following terms.

"What I claim as my invention, is the conical form given to that part of the shaft upon which the cylinder revolves, for the purpose of adjusting them to each other without packing; the attaching the piston to the arm, or lever, in such way as to give it play enough to adapt itself to the chamber of the cylinder. The manner of forming the piston in parts, so as to adjust it to the cylinder; and the particular manner in which the valves are made to slide through the head of the cylinder into the valve chambers."

---

47. For *using Zinc or Spelter for making various articles of Hollow Ware;* Samuel Davis, city of New York, April 18.

The specification is as follows.

"Be it known that I, Samuel Davis, of the city of New York, have discovered that zinc or spelter is well adapted to making various kinds of hollow ware; such as pots, kettles, pans, basins, dishes, pitchers, dippers, ladles, mugs, boxes, mortars, churns, firkins, inkstands, urns, knobs, ornaments for cornices and for stoves, looking glass and picture frames, sad or flat iron stands, andirons, sea boards for vessels. SAMUEL DAVIS."

The specification of a patent obtained by the same gentleman, for *extracting cream from milk,* is inserted at page 368, vol. 6. In this it will be found that vessels of zinc were proposed for containing milk or cream. The claim there made is in the following words: "What I claim is the manner of using the mineral called zinc, or spelter, in the reservoir, or vessels, containing the milk; and *preparing vessels or pans* from the zinc, or spelter." It will be seen, therefore, that the two patents are, in part, for precisely the same thing, and of this the law will not admit; otherwise, instead of having his patent for fourteen years, a man might contrive to render it perpetual.

It appears to us rather strange to say that it has been newly *discovered*, that a well known metal, which has been long since rendered malleable, which has been made into pipes, spouts, and other articles, which has been used for sheathing vessels, and covering houses, and has been cast into various forms, is "adapted to the making of various kinds of hollow ware," &c. If the inquiry be made why this has not been generally practised, we reply that it is entirely unfit for containing articles of food, as it is more readily attacked by acids than any other metal, and as its salts are more or less poisonous.

The total want of novelty in its application to culinary purposes might be easily shown; indeed it is sufficient for this purpose to turn to the article Zinc in Rees's Cyclopedia, where it is observed, that "it has been recommended instead of tin and lead for domestic purposes; but the ease with which it is oxydized, makes it very unfit for all kinds of culinary apparatus."

---

48. For a *Life Escape, and Fire Ladder;* James Johnson, city of Baltimore, April 18.

A car is made to run upon wheels; this car has a considerable elevation, and is so constructed as to form two or more platforms, retiring like steps, one probably ten feet above the other. The ladder, in sections, is to reach from one angle of these platforms to the next above it, where it is to be secured. Firemen with hose may stand upon the platform, and play directly into a window.

The apparatus is very indifferently described, and, as presented, appears liable to many objections. A carriage of this description requires too much space to admit of many of them being kept in large cities. Its elevation is such as to render it very liable to be upset in the hurry of repairing to fires, and when placed against a building which is on fire at the lower part, the machine will be in contact with it, whilst a common ladder would stand clear. There have been many contrivances made for a similar purpose, but they have not proved to be practically useful, being liable to the objections stated, or to others equally formidable.

---

49. For an improvement in *Couches, Sofas, Settees and Chairs,* called the "Windlass couch, sofa," &c.; Charles Adams, Boston, Suffolk county, Massachusetts, April 18.

The claim is to "applying the windlass principle in binding and holding together the parts, and tightening the sacking or other material upon which the cushion lies."

The plan resembles that adopted in bedsteads, and for which a patent was obtained by the same gentleman. The rails are made round, and have round tenons, with a ratchet wheel and click at one or both ends of them. By means of these, sacking bottoms, cords, or similar appendages may be tightened.

The advantages stated to accrue, are the facility with which the before mentioned articles may be kept tight; the rendering the seats always firm and elastic, with less expense of material than when stuffed in the common way. The facility of taking apart and stowing for transportation; and greater economy in construction.

---

50. For an improvement in *Door Locks;* Andrew Wolfe, Pittsburg, Allegheny county, Pennsylvania, April 18.

Spiral springs are substituted for the usual flat spring over the tumbler of a door lock.

"All that I claim as my invention, is substituting spiral springs for the common flat spring. Said springs resting perpendicularly on the tumbler, with the cylindrical piece of metal in the centre of each spring secured to the tumbler, and working loosely in the groove on the under side of the square mortise; thereby rendering the lock more easy in its movements and more durable; the springs not being liable to break or lose their elasticity so soon as the common flat springs."

---

51. For a machine for *Cleaning Fur;* William Woodworth, city of New York, April 19.

(See specification.)

---

52. For an improvement in the mode of *Casting Metallic Tubes,* or pipes, of lead, or other soft metals; Burroughs Titus, Ulyssus, Tompkins county, New York, April 19.

(See specification.)

---

53. For an improvement in the *Navigation of Canals by Boats;* Samuel D. Ingham, New Hope, Bucks county, Pennsylvania, now residing in the city of Washington, April 19.

"This invention consists in the construction of a boat with a paddle wheel, or wheels located in its forward part, or bow, which wheels may be applied to any form of boats now in use, but most advantageously to that form usually denominated a twin boat."

It is proposed sometimes to put two wheels in the bow, in such positions as to propel the water along the interstice between the twin parts of the boats.

It is observed that these wheels may be propelled by steam or any other power; that when steam is used, one boiler and two engines, one on each side of the boat, will be the most advantageous; the pistons being placed horizontally.

The object proposed to be attained, is to prevent the swell of water in front of the boat, and the depression of it in the rear, which occurs when boats are towed, or propelled by paddle wheels on the sides.

There is no claim made, but from the tenor of the instrument, it would appear that the placing of a wheel, or wheels, in the bow of the boat, is the point relied upon. This in itself is not new, and we do not therefore perceive any thing by which the patent is to be sustained.

---

54. For a *Thrashing Machine;* William J. Wood, Gennessee county, New York, April 19.

Instead of a cylinder with teeth, there is to be a wheel like a wagon wheel, one side, or face, of which is to be covered with teeth, or beaters, to a considerable distance from its periphery, towards the centre. This wheel is to run against a corresponding piece furnished with teeth. The construction and arrangement are not clearly described, or distinctly represented in the drawing, nor is there any claim made.

[TO BE CONTINUED.]

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the method of Washing Rags for the manufacture of Paper. Granted to JOHN AMES, *Springfield, Hampden county, Massachusetts, April* 6, 1831.

THE improvement consists in dispensing with the washers, or screens now in use, and substituting in their stead a wire cloth cylinder, for carrying off the dirt and filth which may be beaten from the rags, or held in solution in the water, without the waste and delay of the old mode. The cylinder used by me is about twenty-two inches in length, and twenty-two inches in diameter, hollow, closed at one end, open at the other, surrounded by two coats, or coverings of wire cloth, and revolves upon an axis. I construct the cylinder as follows: the frame consists of metallic rods of suitable length, and sufficient in number to give strength and form to the cylinder, running parallel with the axis, and supported by arms of the same metal. Over these rods is first stretched a coarse wire cloth, and then over that is stretched another wire cloth of finer texture; any reticulated material, however, will do for the inner covering, as its principal object and use is to support the outer one without opposing any considerable obstacle to the free passage of the water into the cylinder. The cylinder is left open at one end, but is entirely closed by a metal disk at the other. Thus constructed, it is fixed in the washing vat, or engine, resting on arbours, with the open end adjusted to the side of the engine or vat, so closely as to prevent a waste of the stock, and placed at a convenient height to allow a free passage of the rags around in the engine.

Within the circle described by the periphery of the open end of the cylinder upon the side of the engine, an orifice is made to let off the water which percolates into the cylinder. A band or gearing connected with other parts of the machinery communicates a rotary motion upon its axis to the cylinder, corresponding with the current, or roll of the stuff in the engine.

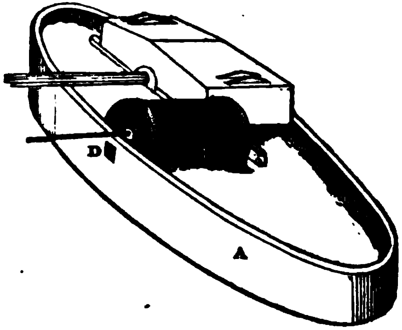
The benefit and utility of this improvement consist, 1st, in the saving of time in the preparing the rags for manufacture; 2nd, in dispensing with the washers now in use; 3d, in preventing a waste of stock, which in the ordinary mode of cleaning is very considerable. By my improved mode the dirty water is made to pass off more rapidly, and of course the clean water can be admitted more freely than when washers are used, through the apertures of which the pulp is driven by the force of the roll, or motion of the beaters, and so wasted, or clogs the washers by filling up the apertures, and prevents the passing off of the dirty water. By the rotary motion of the cylinder, by my mode, coinciding with the roll of the stuff, the water is freely received into the cylinder, and passes off.

The improvement which I claim especially as mine, is the process, or method, of washing, or cleaning, rags, by adapting the wire cloth cylinder to the common washing engine divested of its washers, to effect the objects before mentioned.

The wire cloth cylinder I do not claim as my invention for which I now seek a patent; it having been before patented by me.

John Ames.

Ames' Rag Washing Machine.



A, the vat.

B, the wire gauze covering to the cylinder.

C, the open end of the cylinder running close to the vat.

D, the opening through which water escapes.

Specification of a patent for an improved mode of manufacturing Spades and Shovels, by means of Machinery.—Granted to Charles Richmond *and* Samuel Caswell, Jr., *Taunton, Bristol county, Massachusetts, April 7,* 1831.

To all whom it may concern, be it known that we, Charles Richmond and Saml. Caswell, Jr. have invented an improved mode of manufacturing spades and shovels by machinery; whereby much labour is saved, and the articles manufactured are made with greater truth and uniformity than by the modes hitherto pursued, and that the following is a full and exact description of our said invention.

The principal machinery which we employ is such as is well known to machinists; and to this, therefore, we make no claim, as we have merely so modified it, in size and form, as to adapt it to the purpose to which we apply it. That our mode of procedure may be perfectly understood, we have deposited in the Patent Office of the United States, drawings of the machinery, as modified and applied by us, and also a model of the same, corresponding with the drawings.

This machinery consists, first, of a cutting press, by which the plate prepared for making a spade, or a shovel, is cut out at one operation; and by another operation is punched, to receive the rivets necessary to attach the back strap and coffer, to the plates.

The second part of the machinery is a stamping apparatus, usually called a drop. This has a bed piece, or anvil, which is fixed below the sliding drop, and forms one part of the die by which the spade, or shovel, is to be shaped; the sliding part of the drop is made to correspond to this, and forms the upper part of the die.

To make a spade, or shovel, we take a bar of Swedish, or other, iron, and upon the side of this we usually weld a piece of steel. The bar is then rolled out to the size necessary for forming the spade, or shovel. It is then placed under the cutting press, and is cut out at one operation.

The same press receives dies to cut the strap, and also to punch the requisite holes, each of which is also effected at one operation.

The plates, so cut, are then placed in the drop, and by a single blow receive the form required.

The improvement which we have made in the manufacture of spades and shovels, and for which we claim a patent, is the use of cutters and dies, used in the cutting press and drop, by which the plate of which the spade, or shovel, is to be made, is first cut out, and afterwards stamped into the proper shape, each by a single operation.

CHARLES RICHMOND.
SAMUEL CASWELL, JR.

Specification of a patent for an improvement in the Standing Press, which the patentee denominates the Inclined Plane Friction Roller Press. Granted to LUTHER CARMAN, *Oxford, Oxford county, Maine, April 7th,* 1831.

To all whom it may concern, be it known, that I, Luther Carman, of Oxford, in the county of Oxford, and state of Maine, have invented an improved press, applicable to a great variety of purposes, which press I denominate the *Inclined Plane Friction Roller Press;* and that the following is a full and exact description of the same.

I construct a frame of wood, or iron, in the ordinary form of frames for presses. That is, having cheeks, or uprights, with a bed piece, or sill, and a cap piece strongly framed into, or otherwise attached to, them. Between the cap piece and bed, a third piece is framed, or attached to the cheeks in the same manner. This third piece may be much smaller than the other two, as it merely operates as a guide and support to the other parts, but does not sustain any of the force of reaction from pressure.

The pressing power is derived from the action of friction rollers against an inclined curved surface, which is effected in the following manner. A strong iron shaft has its gudgeons fitted into holes in the cap piece, and the intermediate piece above named. The lower gudgeon passes through this latter piece, as it is by its descent that the pressure is exerted. The upper gudgeon has sufficient play in the cap piece to allow it to ascend and descend the distance required. A wheel, having a wide rim, is attached to this shaft. The upper edge of the rim of this wheel has two scallops, or indentations, made in it, which correspond exactly with each other, and are made of such depth and inclination as may suit the purpose to which the press is to be applied. Two strong friction rollers are attached to the under side of the cap piece of the press; their faces being in contact with the upper rim of the wheel. The wheel is borne up by means of springs, or weighted levers, or by a rope passing over a pulley, carrying a weight sufficient to counteract that of the wheel and axle.

When this wheel is turned by means of a lever, the friction rollers acting upon the indentation on its rim, will cause it to descend either rapidly or slowly, and with a varying degree of speed, or force, depending upon the degree and form of the inclination in the indented parts of the rim. The two rollers, acting at points diametrically opposite, prevent all strain upon the wheel. Where great power is required, cogs are placed around this main wheel, and a pinion with any number of teeth, is employed to turn it; a lever being applied to the shaft, or axle of such pinion.

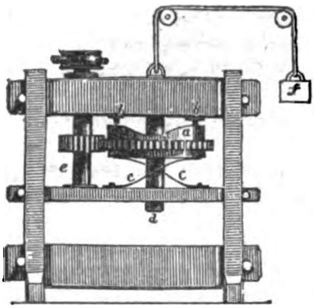
This press may be inverted, in which case the wheel will, by its own weight, rest upon the rollers. It may also, if desired, be made to press in a lateral direction. It is applicable to the purposes of cutting; of raising by means of dies; of printing; pressing bricks, or cheese; and, in fine, to any purpose where great power, and a moderate range, are required.

Cutters, dies, a platten, or follower, &c. may be attached to the end of the shaft, which passes through the intermediate piece above described.

What I claim as my invention, and for which I ask a patent, is the application of friction rollers on the indented edge of a wheel, in the manner, and for the purposes above described.

LUTHER CARMAN.

Carman's Press.



a. The wheel on the rim of which the pressure is exerted.

b, b. Friction rollers bearing against the rim.

c, c. Springs by which the weight of *a* may be sustained.

d. The shaft conveying the pressure by its descent.

e. Pinion, turned by a lever and acting on the teeth of the wheel *a.*

f. A weight which may be substituted for the springs *c, c.*

Specification of a patent for a mode of rendering a variety of articles water proof, by means of Fluid Caoutchouc, and of otherwise using that substance so as to produce new and valuable results. Granted to GEORGE H. RICHARDS, *Washington, District of Columbia, April* 11, 1831.

IT is well known that the substance commonly called gum elastic, or India rubber, but more correctly Caoutchouc, is produced by the desiccation of the sap or juice of several plants, and particularly of the Haevia Caoutchouc, and Jatropha Elastica, growing in the southern part of this continent, and from the Urceola Elastica of Asia. This substance, in the fluid form, has never been applied to the purposes of manufacturing or preparing of many things to which it is peculiarly applicable, although bottles, shoes, boots, balls, and sheets, have been formed thereof in the places where the above named and similar plants grow. It is true, that for the purposes of philosophical experiment, small portions of the juice have been taken to Europe, and brought to this country, but it has never been advantageously employed for purposes of utility, until the same was done by me.

Solutions of the indurated substance, as usually imported, have been made in ether, naphtha, oil of sassafras, spirits of turpentine, the spirits of coal tar, and in other liquids, and a varnish has been thus made which has been occasionally applied to useful purposes. I therefore except from my application and use of caoutchouc, the aforesaid or other solutions, made from the solid material.

In my application of caoutchouc, I obtain it in its original fluid state, and I use it either *substantively*, that is to say, by itself alone, or I employ it in connexion with other substances, as a cement, or as a varnish, for covering, impregnation, saturation, or stiffening. By its use I render the objects to which it is applied either elastic, durable, water proof, or air tight, according to their natures, and the purposes to which they are to be applied.

When used as a cement I sometimes employ it alone, and sometimes I mix it with glue, pitch, tar, or other adhesive articles, and employ it either in a cold or warm state, the latter, or warm state, being in most instances the best.

Without attempting to enumerate, or specify the various objects, or substances, to which I mean to apply the fluid caoutchouc, I will mention a few of them.

I intend to apply it to cloth of every kind, to silk, cotton, ropes, cordage, strings, and all other articles manufactured from fibrous materials. As a varnish to leather, wood, or other porous substances, so as to cover or saturate the same. As a varnish to protect metals from oxidation.

I sometimes mix with the fluid caoutchouc, the metals, metallic oxides, earths, or other solid substances, either simply, or in combination, but generally in a state of minute division, and I thus produce a variety of compound substances, possessing any desired degree of hardness, or combining ornament with utility, according to the nature and objects of the mixture.

The action of atmospheric air, and of solar heat, is sufficient to convert the fluid into a solid substance; but it is best, in general, to facilitate the process, by exposing it to artificial heat. The caoutchouc, or its compounds, may be applied by dipping the article to be covered, or saturated, into it; or a brush may be used in the manner of varnishing. No particular directions are necessary upon this point, as every thing must depend upon the nature of the substance upon which the operation is performed.

I claim as original the useful application of the *native fluid caoutchouc*, as set forth in this specification, either alone or in combination, when employed for the purposes, or in the manner hereinbefore set forth.

George H. Richards.

Abstract of the specification of a patent for an improvement in the manner of constructing Ships and Vessels of every description, either for the purposes of War or Commerce. Granted to Joseph R. Deming, *City of New York, April 15th,* 1831.

The improvement consists in uniting together what may be called sundry horizontal frames of suitable timber, placing them one upon another, in such a manner as to make the hull or external part of the ship or vessel, *one solid wall of timber*, with the exception of the bolts and nuts of metal necessary to secure the said frames firmly together. The grain of the timber is, of course, as near as may be in the direction of the line of a figure forming a horizontal section of that portion of the ship or vessel to which it belongs. The frames above mentioned, and which I have spoken of as being horizontal, are not, however, of necessity, of the same vertical thickness one with another; nor as regards any one frame is the vertical thickness thereof, of necessity, the same in its different parts. For as the vertical depth in all, or nearly all, ships or vessels, is greater at the head and stern than it is amidships, it follows, of course, if a ship or vessel be wholly made of entire frames, piled upon, and firmly secured to one another, that the vertical thickness of these frames will be greater at their extremities than in the middle.

In some instances it is proposed to interpose pieces of timber between one or more pairs of frames, particularly at the stern; the grain to run as nearly as may be in the direction of the length of the ship, and also of the curvature of the part in which it is placed.

Two methods of securing the deck beams are given. One by permitting their ends to extend through the sides of the ship, the beams having, if desired, a shoulder on the inside; they are then to be made fast to the hull by screw bolts, dagger-knees, hanger-knees, &c. The other mode is the making the frame in that particular part of the hull sufficiently thick to extend inwards and allow the deck beams to rest on them, and then securing them as above.

This mode of building dispenses altogether with plank, either on the inside, or outside; and also with standing timbers, except it be a stern post, and one or more short pieces underneath the cut water, to serve as a protection from injury to the part called the gripe.

The mode of building is to shape and lay down the keel much in the usual way. At each end of the upper surface, a piece of timber of proper size and shape, forming the *dead wood*, is attached by screw bolts. Pieces extending from one dead wood to the other are made fast to the keel, by screw bolts; these are to be fitted to the dead wood, and to each other, by *butt joints*, *scarf joints*, or *hook scarf joints*. The bolts being so placed that when the vessel is caulked no part of them will be exposed to the action of the water. These pieces, when so fixed, may be considered as constituting the first frame.

A second frame, with dead wood pieces, is then to be laid on the former, and secured by screw bolts long enough to reach through both frames. Pieces of canvass, dipped in white lead paint, or other suitable preservative matter, are to be laid between the timbers as they are bolted together, but this is not to be done to any greater height. The frames are to be laid successively in this way, recesses being made for the heads of the bolts, and the joints all having the canvass, &c. interposed. Tree nails may also be driven as the work proceeds, boring holes diagonally for this purpose. When built to the proper height, the deck beams are to be secured in their places by one or other of the modes above indicated.

When the vessel is completed, the seams are to be caulked, although, from the manner of screw bolting together, it is nearly impossible that any leak can exist. The timbers are, of course, to be so arranged as to *break joints*.

The advantages proposed to be attained are, the using of less timber, and the obtaining of greater strength; to insure tightness even without caulking; to be able to work on the inside, even at sea, by a temporary removal of the cargo, should a leak occur; to make iron bolts less liable to decay, by protecting them from contact with the water; greater security to persons and property; greater durability, and avoiding the recesses in which foul air is generated.

"*I claim as new*, the foregoing described method of constructing the hull of a ship, or vessel, by uniting timbers piled upon and secured to one another in such manner that the grain of each piece of wood, shall, as near as may be, be in the direction of the part of the said ship or vessel to which it belongs, dispensing with the use of planking, except it be for the decks."

"*I claim as new*, the application of canvass and white lead, or other similar substance, laid in the seams between the timbers, so piled upon and secured to one another by the screw-bolts and treenails heretofore and herein described."

"*I claim as new*, the use of screw bolts to fasten together the various series of frames of timber, above described, in manner such that they may be wholly protected from coming in contact with the water; and,—

"*I claim as new*, the plan herein referred to, of constructing the *trunks*, as they are usually termed, made use of when centre boards are employed in ships or vessels; the advantage which this plan offers consisting in the trunk being made of a series of separate pieces of timber, piled upon and secured to each other by screw bolts, &c. as above mentioned, but each piece being morticed through, to receive the centre board; thus making it practicable to render the trunk perfectly tight; a fact which now seldom or never happens."

JOSEPH R. DEMING.

Specification of a patent for a machine for Cleaning Fur. Granted to WILLIAM WOODWORTH *of the city of New York, April* 19, 1831.

THIS machine consists of a series of wheels, like water wheels, placed near each other in a horizontal frame covered in on the top, and bottom, and sides, the cover being as near the periphery of the wheels as may be consistent with their free motion, and lined with a cloth. A feeder is adjusted to one end, and at the same end of the series of wheels, a picker, which takes the fur as the feeder delivers it, and by the rotation of the wheels, with a certain rapidity, and alternately, in opposite directions, the fur is carried through the series, and as it passes on it is freed from the hair, which is attracted by the cloth lining, and adheres to it, so that the fur issues from the other end of the machine perfectly cleared from hair by a single operation, at which other end is placed a gauze bag or other receptacle in some convenient form to receive the fur as it issues. The wheels may be of the same or of different diameters, and of any convenient length; the beaters thereon constructed, like the buckets or paddles of water wheels, may be of any convenient number and dimensions. The wheels, supported on axes or gudgeons, working in boxes, set in the frame, may be of metal or other material. The frame, made of wood, or other material, consists of two pieces which may be called cheeks; these are supported on a sufficient number of legs, or feet, according to the length of the cheeks, which must be long enough to hold the number of wheels to be used, be they more or less, or larger or smaller. These cheeks are framed together firmly by cross pieces and ties, in such a manner, and of such a length, that the wheels may freely revolve between them, the wheels to be placed at such distances as to revolve freely without touching each other, but as near as may be, consistently with this object. They must be covered in at the ends as well as above and below them—the cover should set close to the top and bottom of the wheels, coming to the sharp angles where the wheels are near each other, and these angles so formed as that the space between the edge of the angles and the wheels will be larger where the fur enters between the cover and the wheels respectively, than where it leaves them respectively. This is convenient, as it favours the passage of the fur from wheel to wheel. The cloth, it is believed, will best answer the purpose which has the coarsest and fullest nap. The attraction and adhesion of the hair to the cloth lining is ascribed to electricity therein produced by the motion of the wheels, and this power of attraction, it is contemplated by the inventor, may be increased in the cloth lining so as to make it electric to any requisite degree by common and known means. The picker, placed as aforesaid, consists of a cylinder with points set therein, so placed in respect to the delivering end of the feeder as to take the fur and tear it from between the delivering rollers of the feeder and distribute it to the wheels as aforesaid. The feeder is of common construction, and the wheels and picker are put in motion by a band running over wheels fixed to their respective axes; the motion of the feeder is adapted to the picker, and the motions of these are adjusted to each other and to the wheels, so that the machine shall have in all its parts a convenient velocity, according to the quantity of fur to be cleared and the supply conveyed to the machine by the feeders in a given time. The number of wheels and their dimensions are left at large, because these may be indefinitely varied, and yet the principle of the machine be the same, as hereinafter is shown. But the number of wheels, and their dimensions, actually used by this applicant in his first operation, were as follows—there were 7 wheels from 6 inches to 2 feet in diameter. The dimensions of the frame, and of the cover, and of the picker, and of the feeder, all obviously depend upon, and are adapted to the number and dimensions of the wheels. By a machine of this description the applicant has cleared fur of hair perfectly in one operation.

The principle of the invention consists in the combination of wheels with a cover lined with cloth, substantially, as above described, having a feeder and a picker of common construction, the dimensions of the same being variable at convenience as aforesaid.

And this applicant contemplates the application of this principle in combination with any common and known apparatus for electrifying the cloth lining, and purposes on further experiments to apply for patents for such and other improvements.

WILLIAM WOODWORTH.

Woodworth's Machine for Cleaning Fur.

Fig. 1.

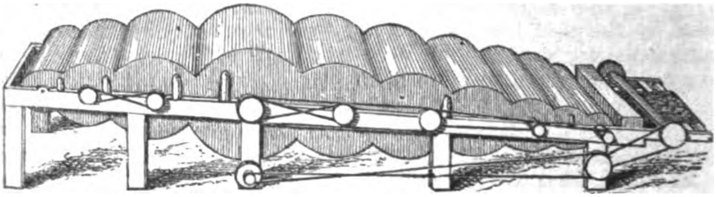


Fig. 2.

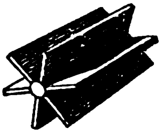


Fig. 1, a perspective view of the whole machine.

Fig. 2. one of the wheels, or beaters, which revolve in the cylindrical cases.

Abstract of the specification of a patent for an improvement in the mode of casting and making of Metallic Tubes, or Pipes, of lead and other soft metals, or composition of metals. Granted to BURROUGHS TITUS, *Ulyssus, Tompkins county, New York, April* 19, 1801.

THE object of this patent is to produce pipes of any desired length, without seam or joints. The plan is to conduct the fluid metal into a mould of a proper form, but of moderate length, and causing the metal to be cooled so as to adhere, and at the same time giving a regular motion to the tube, so as to draw or force it from the mould as fast as it becomes effectually cooled.

The apparatus by which this is to be effected is shown in the accompanying drawing.

A, A, is a hollow cylinder of metal, bored out, so that its inner diameter shall be equal to that of the pipes intended to be cast. Its length for a pipe of 1¼ inch, may be about 8 inches. It has a flanch, *a, a,* at its lower end. This tube gives the form to the outside of the pipe to be cast. B, is a plug or core, adapted to the inside of the pipe, and made of iron, or other suitable metal; it must be perfectly smooth, and slightly tapering, being smallest at top. It has a flanch, *b, b,* adapted to the flanch *a, a;* this flanch is perforated with a number of holes, to allow the fluid metal to pass up into the mould. C, C, is a basin to contain water, standing up to the dotted line, *f, f.*

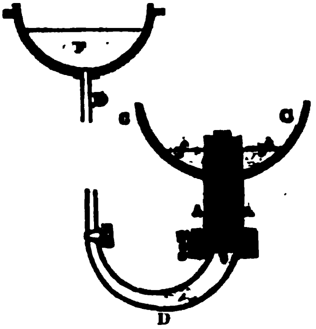
D, D, is a tube by which the melted metal is to be conveyed from the melting pot, F, into the mould. A, stop cock, regulates the flow of the metal. The tube, D, D, is furnished with a flanch, *c*, by which it is connected with the mould.

The melting pot may be placed so high up that the pressure of the melted metal will be sufficient to force the pipe from the mould, with a regular motion, as it is cooled by the water, this force being regulated by the quantity admitted by the stop cock. The pipe, D, D, must descend through a flue kept sufficiently heated to keep the lead in a fluid state, and heat must also be applied at its junction with the mould. Instead of elevating the melting pot, an arrangement may be made for making a mechanical pressure upon the surface of the lead, and thus to produce the same effect.

The pipe, as it is forced off, may be received upon a reel, or drum, placed above the mould.

We have omitted a large portion of the specification, but have given what is necessary to render the plan intelligible. A patent has been obtained in England for machinery for the same purpose, but not of the same construction. We believe that under proper modifications, which experience alone must suggest, the principle above described may be advantageously applied to the accomplishment of the object proposed.

Titus's Machine for Casting Pipes.



ENGLISH PATENTS.

Patent granted to Matthew Uzielli. *The preparation of certain metallic substances, and the application thereof to the sheathing of Ships, &c. Communicated by a Foreigner. Dated January* 6, 1831.

The invention consists in giving ductility and malleability, (for the purpose of making it into sheets,) to an alloy composed of copper and tin solely, or which is so far free from the admixture of zinc or lead, as to be harder and less liable to oxidation than pure copper or common sheet brass, and which alloy is brittle when first cast, and before it is subjected to the process hereinafter described, but is thereby made into malleable and ductile sheets, which, from their being less liable to oxidation than pure copper, are therefore more applicable to the sheathing of ships, for covering roofs of buildings, making spouts and gutters, and other purposes where sheets are required, which will not be liable to much oxidation.

This alloy I would recommend to consist of copper and tin only; for although an admixture of zinc or lead in small proportions, which will not be sufficient to make an alloy laminable into thin sheets by any process hitherto used, say one or two per cent., will not very materially increase its liability to oxidation, while it renders it a little less brittle, and therefore more easily manufactured, still every little addition will increase its liability to oxidation, and therefore is better avoided: the proportions which I have found best adapted for the purposes before mentioned, are one hundred of copper, with five to seven of tin. A less quantity of tin than about five per cent. makes an alloy which is too liable to oxidation, and is little preferable to pure copper; and a greater quantity than about nine per cent. makes an alloy so hard and brittle, and requires so much care and labour to make into malleable sheets as to become too expensive an article for sale. This alloy is manufactured into malleable and ductile sheets in the following manner:—Having melted the copper in a reverberatory, or any other furnace adapted to the purpose, or in crucibles, the tin is added, as also the zinc or lead, if the alloy is to contain any, and then the metals are to be mixed and well incorporated together by stirring whilst in a state of perfect fusion. The melted mixture, or alloy, is then to be well heated, and a sufficient quantity is to be poured into moulds formed between two strong tables of smooth granite or other suitable substance, so as to obtain a flat plate of from three-eighths to three-fourths of an inch in thickness, according to the ultimate thickness of the sheets required. The thickness, length, and breadth of the plates, may be varied according to circumstances, by the thickness and position of metal rules, which are to be interposed between the tables of granite to keep them apart, and to leave the space which forms the mould for the melted metal. The plates thus cast may be cut into smaller pieces, according to the size of the sheets ultimately required, or the original size of the plates may be adapted thereto, taking care in either case to allow twenty to twenty-five per cent. for waste in the manufacture. It is better that each plate should contain a sufficient quantity of metal to form two or four sheets, so as to be doubled up and rolled in a subsequent stage of the process. These plates are placed in an annealing furnace, or in any other furnace adapted to the purpose, where they are very gradually heated for two or three hours until the plates are raised to a dull red heat, when the alloy contains from five to seven per cent. of tin; but if it contains more tin, the heat must be lower and applied more gradually, and if it contains less tin, the reverse. The plates are then allowed to cool very gradually, which will take about an hour, and when perfectly cold are passed three or four times through the rollers of a suitable rolling-mill, which are set so as to effect but a very slight reduction of the thickness of the plates. The rollers should be so adjusted during the first cold rolling, after the first annealing, that when the alloy contains the proportions before recommended, of five to seven per cent. of tin, passing these three or four times between the rollers, should not lengthen plates of the thickness before mentioned more than about half an inch in two feet length; but if the alloy contains more tin they must not be lengthened so much, and if it contains less tin, the reverse: great care must be taken that in this and subsequent rollings the plates be rolled always in the same direction. The plates must then be again annealed, taking the same precautions in heating and cooling very slowly, and to the same degree as before, and again rolled in a cold state with the same precautions as to the pressure of the rollers, and in rolling the plates in the same direction as before. The annealing and rolling are repeated with the same precautions, and to the same extent, until the texture of the alloy is changed, as may be known by the fracture being found close and fine grained, instead of crystalline and with facets as when it was first cast. With the proportions before recommended, the close and fine grained texture generally takes place after twelve or fifteen successive operations of annealing and cold rolling. After the texture of the alloy becomes thus changed, it may be heated more rapidly and to a higher temperature, and when cold rolled, so as to lengthen plates, which, when first cast, were of two feet length, six or seven inches after each annealing. The plates, or sheets, as they may be now called, may then be bent up and rolled double, in the usual manner of rolling brass sheets, but continuing always the precaution of rolling in the same direction.

After sufficient rolling the sheets may, if necessary, be doubled again, according to the thickness and size of the sheets required, and when sufficiently rolled, the sheets are to be trimmed and cut to the required dimensions, as usual in rolling brass or copper. The precautions particularly to be observed are casting the alloy in thin plates, heating and cooling them very gradually, and rolling them cold, very gently at first, in the same direction.

Now, I declare, I do not claim as part of the invention the making of sheets of an alloy, which is commonly called brass, and which has heretofore by repeated annealings and cold rollings, in a method somewhat similar to my own, been made into malleable and ductile sheets, but which alloy commonly called brass, is composed of copper, with a large proportion of zinc, or of copper, with a large proportion of zinc and a certain proportion of tin or other metals, but is more liable to oxidation than fine copper, and therefore not so fit for the purposes before mentioned; but I do only claim giving malleability and ductility, for the purpose of making it into sheets, to an alloy which is less liable to oxidation than fine copper or brass, and which heretofore, from its brittle nature, has not been manufactured into sheets.

In witness whereof, &c.

Patent granted to Andrew Ure, *of Southampton Row, in the county of Middlesex, M. D., for an improvement or improvements in curing raw or coarse sugars. Dated October* 20, 1830.

The nature of this process consists in employing faintly acidulated alcohol as a solvent to remove the quicklime and glutinous extractive with which raw sugars are mingled.

The proportion of acid employed is one ounce of sulphuric, nitrous, or other, powerful acid, to one gallon of alcohol, at forty degrees above proof.

The sugar cleared by this mixture, it is stated, will be sufficiently freed from impurities as to admit of its being packed in bags instead of hogsheads.

The claim is not for the use of the alcohol, but for the combination of the latter with the acid for the purpose mentioned.

Patent granted to John Dickenson, *of Nash Mills, in the parish of Abbot's Langley, in the county of Hertford, for an improved method of manufacturing Paper by means of machinery. Dated October* 6, 1830.

The object of the present patentee is to make paper in two layers or strata, before such layers leave the felts by which they are conducted to the drying machinery; for this purpose two cylinders of woven wire are immersed in two vats of pulp some distance apart. The pulp collected on the first cylinder is conducted by a felt and the necessary rollers to the second cylinder, from whence the two layers, thus coming in intimate contact, are carried forward by the same felt to the press-rollers, (of which there are two pair,) that form them into a single substance—this is then conveyed to the drying machinery in the ordinary manner.

This method is chiefly applicable to the manufacturing of thick papers, the adhesion being greater when the layers are thus joined, whilst in a wet state, than when united subsequently to their passing the drying apparatus.

Patent granted to Andrew Ure, *of Southampton Row, in the county of Middlesex, M. D., for an Air-stove apparatus, for the exhalation and condensation of Vapours. Dated October* 20, 1830.

This invention consists in drawing a stream of air by an exhauster through a chamber over the surface of any moist substance so heated as to exhale vapours, and then propelling the mingled air and vapour through a body of cold water, or other absorbing body, for the purpose of condensation.

The chamber is directed to be constructed of wood, copper, or other suitable material, and of a rectangular form, (as being most convenient,) and much longer in proportion to its depth. At one end of the chamber, immediately below the roof, is a pipe, through which the vapour exhaled from the substance under operation is extracted; it is connected with an exhauster, which propels the vapour into a cistern where it is condensed. At the opposite end of the chamber to that where the exhausting pipe is fixed, is a sliding door, which may be opened to admit a stratum of air sufficiently thick, according to the intensity of the heating medium, in order to facilitate the exhalation. The substance to be evaporated may be heated by steam pipes or hot water, contained in a second chamber below the evaporator.

This apparatus, it is observed by the patentee, is particularly suited for evaporating raw sugars without injuring their quality.

Patent granted to MICHAEL DONOVAN, *of the City of Dublin, Gentleman, for an improved method of lighting places with Gas. Dated October* 6, 1830.

THE patentee commences his specification by observing, that there are many gases which burn with but a small emission of light, such as hydrogen gas, carbonic oxide gas, and that gas produced by the chemical action of water or steam on the surface of red-hot coke or charcoal. He proposes to produce a good light from these gases by combining them with the vapours of certain volatile substances, such as spirits of turpentine, vegetable resins, naphtha, and naphthaline.

In order that vapour should be produced from these substances, a reservoir is directed to be placed near the burner, so that the heat emitted from the burner itself may produce the necessary effect. The distance of this reservoir from the flame is to be regulated according to the degree of volatility of the substance employed; for, if naphtha be employed that has been several times distilled, it will produce vapour at the temperature of the atmosphere, the reservoir must be in that case removed some distance from the burner, or much smoke will be emitted with the flame, according to the excess of vapour; if, on the other hand, sufficient vapour be not mingled with the gas the light will be less bright.

The gas, (in the instance cited by the patentee,) is generated in a cylindrical iron retort, of about eight inches diameter in the interior, and about three and a half feet in length. This being filled with coke or charcoal, over which water or steam has been thrown, is to be heated to a red heat. The gas thus produced is conducted by a pipe to the lower end of what is termed the recipient, consisting of a small tube or cylinder below the burner. A tube of about half the diameter of this recipient arises concentrically with the latter from the gas supply pipe: this tube, which is perforated with numerous small holes, is denominated the disperser; near the top of this a division is made to prevent the gas from passing through the upper part without mingling with the vapour, and several convolutions of fine woven wire are wrapped around the disperser to render it more effectual in causing a perfect intermixture. The combined vapours then pass into a burner similar to those usually employed for gas, and it is stated they will then afford a clear and bright light.

New Dye.

We live in an age of improvements. Last week our *Gazette* contained the first public intimation and account of a discovery which promises every man his dram with his bit of bread; since the loaf, in its baking, is found to give out a vapour which needs only to be collected to furnish an excellent spirit. Now, therefore, ovens may also be considered as stills, and the staff of life will be the more required to support those whose heads it may tend to turn by its odorous products. But our present purpose is with a new method of dying with Prussian blue, which is stated to be so efficient and cheap, as entirely to supersede the necessity for indigo. The prospectus issued by the inventors of this commercially important composition is now before us. It states that since the year 1752, the attention of the most able chemists of Europe has been directed to the discovery of some means by which a fast blue dye might be obtained without the use of indigo; but that hitherto their researches have been attended with no favourable results, inasmuch as the use of Prussian blue, (the only substitute that could be used,) has been found to render the wool too hard to work well, and at the same time to burn it. But the inventors, who, we believe, have secured their discovery by a patent, assure us that their experiments have succeeded, and that they are prepared to submit to the public, specimens of blues, which have been produced without indigo; the tints of which are equal, if not superior to any colour that has yet been produced by that dye, and its durability incomparably superior. Specimens, they add, will be produced of clothes that have been worn until there literally remained but the thread, and yet the colours are as firm as when first the cloth was cut, nor is there the slightest appearance of white upon any of the seams; a fastness of dye which has never been produced by indigo. We ought to mention that these specimens have been exhibited to us, and that they fully bear out the description given. Among the advantages which the proprietors promise from the adoption of this dye, are the following:—All the substances which compose it are indigenous to all countries, are abundant and cheap, not only in consequence of their great plenty, but also from many of them being absolute refuse, such as old woollen rags, meat unfit for use, blood, entrails, and, in fact, every description of animal matter, however corrupt may be its state:—as a new branch of industry, the manufacture would be a national benefit:—a much greater solidity, beauty, and brilliancy of colour, than hitherto attained, and a capability of being brought to any tint required:—in an apparatus of equal capacity, three times more wool can be dyed by this process in a given time, and at an infinitely less cost than can be dyed by indigo:—wool dyed by the new process is in every respect better to work, is softer, cards better, and is more pleasant and easy to weave than when dyed with indigo:—it is not only applicable to blues, but is equally efficient as the foundation for blacks and greens; those colours being produced of the most beautiful tints;—for hats, the beauty and intensity of the black it produces, and the rapidity with which the operation of dying is performed, renders the discovery invaluable to that branch of trade. Such are the advantages proposed by the adoption of this process; and assuredly a discovery which would lower the price of articles of universal consumption and in constant use, and open a home employment of great extent, in the room of foreign and imported produce, is well worthy of the consideration of a commercial people. We can only speak of the thing from what we have seen, and the old and new clothes shown to us seemed completely to warrant the pretensions which accompanied them. We have no doubt but that both practical skill and large capital will soon put this novelty to the test; and were it ours, we should not be afraid to "stand the hazard of the die." [*Lit. Gaz.*

The Monthly American Journal of Geology and Natural Science.

Two numbers of the above Journal have issued from the Philadelphia press, under the editorial management of G. W. Featherstonhaugh, Esq. We hailed the work in advance as likely to promote the knowledge of a very interesting department of science, but we have to regret that the editor has already given proof of a total absence of those dispositions and habits without which a person is altogether unfit to become one of the sentinels of science. In his notice "*to readers and correspondents*," he has charged this Journal with having "become the vehicle of defamation in its most insidious form," and has designated one of the most usefully active members of the Franklin Institute, as "one of the most insignificant of their members," "an intriguing pharasaical individual," an utterer of "*a deliberate falsehood*," "a mendacious little individual," and "a parasite who lives by dishonouring the labours of others." The original offence of the gentleman so designated, was his differing in opinion with Mr. Featherstonhaugh respecting the organic remains of an extinct species of animal; which offence he aggravated by openly defending his opinions before the Philosophical society.

Mr. F. no doubt imagines that the *provocation* which he has received, will suffice to justify the coarse epithets, and personal abuse, to which he has resorted; we apprehend, however, that to this opinion he will make but few proselytes. He appears to have forgotten "the divine feelings of religion,"* and certainly endangers the accomplishment of his main purpose, which he tells us "is not to win opinions from a limited number of selfish individuals, more interested in *humbugging* the public than in enlightening it."* We hope that when he endeavours "to instruct and amuse the millions,"* he will perceive the necessity of uttering the lessons of wisdom with the tone of a gentleman, and in the elevated language which belongs to the real philosopher.

---

* P. 91, Journal of Geology.

Meteorological Observations for July, 1831.

Moon.	Days.	Therm.		Barometer.		Dew point	Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2 P.M.		Direction.	Force.		
				Inches	Inches.				Inches.	
	1	68°	78°	30.00	30.00	68½	SE.	Moderate.		Rain--cloudy.
☾	2	69	79	.90	.00	70	SE.	do.	.4	Cloudy—rain.
	3	70	72	.90	.00	71	S. W.	do.	.6	Fog—shower.
	4	72	82	.90	.10	71	SW.	Breeze.	.11	Fog—clear.
	5	72	83	.5	30.00	68	SW.	do.		Clear—flying clouds.
	6	71	76	29.90	29.85	68	SW.	do.	1.00	Cloudy—rain. Rain night,
	7	72	74	.80	.80	73	SW. SE.	Moderate.	4.50	Cl'dy--rain. [thun.&light.
	8	70	80	.85	.85	74	SE.	do.	.66	Fog—Flying clouds.
⊗	9	72	74	.75	.75	70	SE. SW.	do.	.90	Rain night, thun. & light.
	10	57	71	.80	.90	50	W. W.	do.	.71	Drizzle—cloudy—rain.
	11	53	71	30.10	30.16	47	NNW. N.	do.		Clear—flying clouds.
	12	53	74	.90	.90	49	W. W.	do.		Clear day.
	13	54	72	.10	30.00	51	SW. S.	do.		Clear day.
	14	63	77	29.84	29.80	60	N. W.	do.		Clear day.
	15	66	78	.75	.75	63	W. W.	Breeze.		Clear day.
☽	16	62	75	.80	.80	49	W. W.	do.		Clear day.
	17	60	78	.83	.83	57	W. W.	Moderate.		Clear day.
	18	65	79	.83	.74	69	SW.	Breeze.		Clear day.
	19	72	85	.75	.75	64	W. W.	do.	.7	Clear day.
	20	71	86	.75	.70	68	W. W.	do.	.8	Clear—shower.
	21	70	85	.70	.70	66½	W. W.	do.		Clear day.
	22	71	86	.70	.72	66	W. W.	do.		Clear day.
	23	73	85	.70	.60	70	S. S.	do.	47.	Cloudy—showery.
☺	24	70	82	.70	.80	65	W. W.	Moderate.		Clear day.
	25	63	81	.80	.83	63½	W. W.	do.		Clear day.
	26	74	80	.60	.63	66	S. W.	Breeze.	.7	Cloudy—thunder shower.
	27	72	84	.80	.90	66	W. W.	do.		Clear—overcast.
	28	73	82	.83	.80	73	W. W.	do.		Clear—cloudy.
	29	70	82	.90	30.00	61	W. W.	do.		Clear day.
	30	65	84	30.00	.00	64	W. W.	do.	.5	Clear—shower.
	31	72	87	29.92	29.90	73	SW.	do.	.15	Clear—shower.
	Mean	67.27	79.42	29.88	29.86	64.3			8.87	

	Thermometer.	Barometer.
Maximum height during the month, . .	87. on 31st	30.16 on 11th.
Minimum do. . .	71. on 10th and 11th.	29.60 on 23d.
Mean do. . . .	73.34 . . .	29.87

---

* P. 91, Journal of Geology.

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

SEPTEMBER, 1831.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the height of Water in Boilers of Locomotive Engines.

By Franklin Peale.

The gauge cocks of boilers, are certainly one of the most important parts of a steam engine; upon their indications we rely for the knowledge of the proper height of water in the boiler, and, of consequence, for the full and efficient operation of the engine; and what is of no less importance, the safety of all who may be within reach of its influence. Any facts, therefore, relative to this portion of an engine, must be acceptable to the public.

High pressure, alone, being applicable to locomotive purposes on land, our observations must be considered as applying particularly, though not exclusively, to this variety of steam power.

When a boiler, in which the steam is raised, is at perfect rest, that is to say, when the engine which it is intended to supply is not in motion, or otherwise disturbed, the surface of the water, or as it is called, the "water line," is accurately defined, and if, for the sake of illustration, we suppose that gauge cocks were placed at fractions of an inch in relative height, the position of the surface of the water would be indicated with great accuracy at the moment when the cock at the same elevation was opened, but if it is kept open, a current is established in the direction of the escape, and it is no longer a perfect indication. So true is this, that if you open a cock some distance above the surface of the water, steam only, at first, passes out, but ultimately steam and water, and the duration of the interval between the opening and the appearance of water, will depend on the relative height of the gauge cock, the surface of the water, and the degree of pressure upon the boiler at the time at which the experiment is made.

One of our papers, a few months back, contained a statement of a fact intimately connected with this subject, observed upon the trial of a model engine, and also asked for a solution of the phenomenon, which may, I think, readily be given.

The statement, if we remember rightly, says, that steam was raised in a small high pressure boiler, the safety valve of which was then lifted by hand; the steam was immediately followed by water, and ultimately the whole of the water in the boiler was expelled through the valve.

I have frequently lifted the safety valve of a small boiler, with invariably the same result; water always made its appearance after a brief interval. The solution is easy—a certain quantity of heat is contained in the water of the boiler, which, when the pressure is taken off, by the raising of the valve, is sufficient to cause the water to rise in foam, and is nothing more or less than is expressed in the language of the kitchen, by the phrase, "the kettle is boiling over."

When an engine is set in motion, and the steam thereby taken off, the ebullition necessary for a further supply, disturbs the surface of the water, and the gauge cock is no longer so decided in its indications, but requires a considerable degree of practical experience to be able to decide, from the appearance of the escaping steam and water, the precise height of the water line, but to a sufficiently practiced eye there is no difficulty. It is not so when a locomotive engine is running on a rail-way. The agitation of the engine is considerable, and a correspondent effect is produced on the water in the boiler, and it then becomes extremely difficult, if not impossible, to tell its height. This is a fact of immense importance in the management of an engine, and yet it is one that was not anticipated by men of science, and of which even practical engineers were uninformed. In company with several engineers, and other gentlemen of science, at a recent trial of a locomotive engine, I was witness to a case exactly in point; it was in action without locomotion; the wheels being raised so as to prevent adhesion; the gauge cocks all indicated water; the engine was then stopped, when, to the surprise of those present, no water was found at the lowest cock, and no human being could ascertain what was the height of water in the boiler at that time, a circumstance that should never occur, for reasons that every one who has any knowledge of the subject must know and admit.

It is much easier to state the difficulty than to devise a remedy. We have received as yet little or no assistance from our more experienced predecessors, the English. The general form and arrangement of their engines, and the results of trials with them, is nearly all we know; what we require is minute descriptions of the important parts of the engine, and full and close details of their management. Information of this character will be of the utmost utility.

At present we must rely on the care of engineers in this matter; the supply pump must be efficient in its operation; the quantity of water supplied in a given distance must be known and governed by the combined and relative velocity and load; and, above all, there must be frequent stoppages at short distances for the purpose of examination.

Careful experiment and sufficient experience may give confidence, but it is extremely desirable that the state of water in boilers should be made more evident to observation than appears to be possible with the present arrangement.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

(Continued from p. 40.)

TABLE D.—PART I.

CHUTE No. 1.—*Gate c. Over-shot. Centre buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	1.00	875	55.34	930.34	41.5	41	9.53	2835	23.00	652050	386091	592	- -	- -	Much water thrown over side of wheel.
2					978	57.14	1035.14		45	8.69	3025		695750	429583	.617			Air vents closed.
3					1081	58.94	1139.94		50	7.82	3280		754400	473075	627			
4					1184	60.74	1244.74		52	7.52	3560		818800	516567	630			
5					1287	65.11	1352.11		57	6.85	3850		885500	561126	634	.634	6.86	
6					1390	69.48	1459.48		61	6.40	4180		961400	605684	.630			
7					1493	73.85	1566.85		65	6.01	4500		1035000	650243	628			
8					1596	78.22	1674.22		71	5.50	4850		1115500	694801	623			
9					1699	82.59	1781.59		79	4.95	5280		1214400	759360	.609			
10	2.75	3.00	3.60	1.25	1596	78.22	1674.22	41.5	59	6.62	4850	23.00	1115500	694801	623	.623	6.62	Much water wasted.
11					1699	82.59	1781.59		63	6.20	5175		1190250	739360	.611			
12					1802	86.96	1888.96		67	5.83	5550		1276500	783918	.614			
13	1.25	1.50	2.10	1.25	1184	60.74	1244.74	41.5	69	5.66	3750	21.50	806250	516567	640	6.40	5.66	
14					1287	65.11	1352.11		76	5.14	4125		886875	561126	632			
15					1390	69.48	1459.48		79	4.95	4440		954600	605684	.634			
16	0.75	1.00	1.60	1.50	978	57.14	1035.14	41.5	58	6.73	3125	21.00	656250	429583	654			
17					1081	58.94	1139.94		63	6.20	3400		714000	473075	662			
18					1184	60.74	1244.74		69	5.66	3690		774900	516567	.666	.666	5.66	
19					1287	65.11	1352.11		76	5.14	4075		855750	561126	656			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE D.—PART II.

CHUTE No. 1.—*Gate c. Over-shot. Centre buckets. Close breast. Water let on at upper centre of wheel.*

No. of Experˢt.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wᵗ of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	0.50	0.75	1.35	1.50	875	55.34	930.34	41.5	68	5.75	2925	20.75	606937	386091	.636			
21					978	57.14	1035.14		75	5.21	3200		664000	429583	.646			
22					1081	58.94	1139.94		84	4.65	3500		726250	473075	.651	.651	4.65	
23	0.50	0.75	1.35	2.00	875	55.34	930.34	41.5	60	6.51	2900	20.75	601750	386091	.641			
24					978	57.14	1035.14		67	5.83	3150		653625	429583	.657			
25					1081	58.94	1139.94		75	5.21	3450		715875	473075	.660	.660	5.21	
26					1184	60.74	1244.74		84	4.65	3775		783312	516567	.659			
27	2.75	3.00	3.60		772	53.54	825.54	4.51	40	9.17	2650	23.00	609500	342599	.562			Air vents open.
28					875	55.34	930.34		42	9.30	2885		663550	386091	.582	.582	9.30	
29					978	57.14	1035.14		48	8.14	3225		741750	429583	.579			
30					1081	58.94	1129.94		53	7.37	3560		818800	473075	.577			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE E.—PART I.

CHUTE No. 2.—*Elbow buckets. Close breast. Bottom of gate seventeen feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wtofwater expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	6.00	7.66	8.82	0.25	463	47.99	510.99	41.5	56	6.98	1750	23.00	402500	212061	.527			
2					566	49.76	615.76		50	7.82	2025		465750	255540	.548			
3					669	51.57	720.57		56	6.98	2350		540500	299020	.553			
4					875	55.03	930.03		62	6.30	3000		690000	385979	.559	.559	6.30	
5					1184	60.38	1244.38		90	4.35	4100		943000	516418	.547			
6					1287	64.74	1351.74		107	3.65	4575		1052250	516567	.533			
7	6.00	7.66	8.82	0.50	1287	64.74	1351.74	41.5	60	6.51	4050	23.00	931500	560972	.602			
8					1390	69.11	1459.11		53	7.37	4275		983250	605531	.616			
9					1493	73.48	1566.48		56	6.98	4600		1058000	650089	.614			
10					1596	77.85	1673.85		58	6.73	4900		1127000	694643	.617	.617	6.98	
11					1699	82.22	1781.22		63	6.20	5250		1207500	739206	.612			
12					1802	86.59	1888.59		68	5.75	5600		1288000	783765	.608			
13					1905	90.96	1995.96		72	5.43	5975		1374250	828323	.602			
14					2008	95.33	2103.33		87	4.49	6525		1500750	872882	.581			
15					2111	99.70	2210.70		95	4.11	6875		1581250	917440	.580			
16					2214	104.07	2318.07		104	3.76	7340		1688200	961999	.569			
17					2317	108.44	2425.44		112	3.49	7825		1799750	1006557	.559			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE E.—PART II.

CHUTE No. 2.—*Elbow buckets. Close breast. Bottom of gate seventeen feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Secs.	Feet.	Pds.	Feet.						
18	3.75	5.41	6.57	0.25	463	47.99	510.99	41.5	47	8.31	1775	20.75	368312	212061	.576			
19					669	51.53	720.53		58	6.74	2400		498000	299020	.600	.600	6.74	
20					875	55.07	930.07		80	4.87	3125		648417	385979	.595			
21					978	56.84	1034.84		88	4.44	3475		721062	429458	.595			
22					1081	58.61	1139.61		98	3.99	3850		798875	472938	.589			
23					1184	60.38	1244.38		112	3.49	4275		887062	516418	.582			
24					1287	64.74	1351.74		127	3.08	4685		972137	560972	.577			
25	3.75	5.41	6.57	0.50	1287	64.74	1351.74	41.5	67	5.83	4225	20.75	876687	560972	.639	.639	5.84	
26					1390	69.11	1459.11		78	5.01	4650		969875	605531	.624			
27					1493	73.48	1566.48		90	4.35	5100		1058250	650089	.614			
28					1699	82.22	1781.22		90	4.35	5875		1219062	739206	.604			
29					1905	90.96	1995.96		102	3.83	6675		1385063	828333	.598			
30					2008	95.33	2103.33		116	3.37	7185		1490887	872882	.585			
31	0.75	2.41	3.57	0.50	463	47.90	510.99	41.5	43	9.09	1725	17.75	306187	212061	.692			
32					669	51.53	720.53		57	6.86	2350		417125	299020	.717			
33					875	55.07	930.07		75	5.21	2975		528062	385979	.731	.731	4.88	
34					978	56.84	1034.84		89	4.40	3325		590187	429458	.727			
35					1081	58.61	1139.61		95	4.11	3685		654087	472938	.723			
36					1184	60.38	1244.38		109	3.95	4050		718875	516418	.718			
37					1287	64.74	1351.74		121	3.22	4425		785437	560972	.714			
38					1390	69.11	1459.11		122	3.20	4810		853775	605531	.709			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE E.—PART III.

CHUTE No. 2.—*Elbow buckets. Close breast. Bottom of gate seventeen feet above bottom of wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
39	0.75	2.41	3.57	0.75	1390	69.11	1459.11	41.5	90	4.35	4790	17.75	850225	605531	.712	.712	4.35	
40					1493	73.48	1566.48		103	3.79	5200		923000	650089	.704			
41					1596	77.85	1673.85		111	3.52	5575		989562	694643	.701			
42					1699	82.22	1781.22		118	3.31	5960		1057900	739206	.698			
43					1802	86.56	1888.56		126	3.10	6310		1120025	783752	.699			
44	0.75	2.41	3.57	1.00	1802	86.59	1888.59	41.5	99	3.95	6400	17.75	113600	783765	.690			
45					1905	90.96	1995.96		108	3.62	6575		1167062	828323	.709	.709	3.62	
46					2008	95.33	2103.33		111	3.52	7075		1255812	872882	.695			
47					2111	99.70	2210.70		117	3.34	7475		1326762	927440	.691			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE F.—PART I.

CHUTE No. 2.—*Centre buckets. Close breast. Bottom of gate seventeen feet above bottom of Wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of Bkt.	Btm. of Bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	6.00	7.66	8.82	0.50	669	51.53	720.53	41.5	37	10.56	2775	23.00	638250	299020	.468			
2					772	53.30	825.30		39	10.02	3110		715300	342499	.478			
3					875	55.07	930.07		43	9.09	3435		790050	385979	.488			
4					978	56.84	1034.84		49	7.98	3725		856750	429458	.501			
5					1081	58.61	1139.61		56	6.98	4030		926900	472938	.510			
6					1184	60.38	1244.38		60	6.50	4350		1000500	516418	·516			
7					1287	64.74	1351.74		59	6.62	4570		1051100	560972	.533			
8					1390	69.11	1459.11		57	6.86	4800		1104000	605531	.548	.548	6.86	
9					1493	73.48	1566.48		68	5.75	5175		1190250	650089	.546			
10					1596	77.85	1673.85		76	5.14	5825		1339750	694643	.518			
11					1699	82.22	1781.22		81	4.83	6230		1432900	739206	.515			
12	3.75	5.41	6.57	0.50	978	56.84	1034.84	41.5	51	7.66	3800	20.75	788500	429458	.544			
13					1081	58.61	1139.61		57	6.86	4150		861125	472938	.549			
14					1184	60.38	1244.38		71	5.50	4525		938937	516418	.550			
15					1287	64.74	1351.74		66	5.92	4820		1000150	560972	.560	.560	5.92	
16					1493	73.48	1566.48		82	4.77	5675		1177562	650089	.552			
17	3.75	5.41	6.57	0.75	1081	58.61	1139·61	41.5	46	8.50	4025	20.75	835187	472938	.566			
18					1390	69.11	1459·11		60	6.50	5025		1042687	605531	.580	.580	6.50	
19					1493	73.48	1566.48		65	6.01	5475		1136062	650089	.572			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE F.—PART II.

CHUTE No. 2.—*Centre buckets. Close breast. Bottom of gate seventeen feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	0.75	2.41	3.57	0.50	772	53.30	825.30	41.5	86	4.54	3525	17.75	625687	342499	.544			
21					875	55.07	930.07		86	4.54	3850		683375	385979	.564			
22					978	56.84	1034.84		88	4.44	4200		754500	429458	.576	.576	4.44	
23					1081	58.61	1139.61		111	3.52	4775		847562	472938	.555			
24	0.75	2.41	3.57	0.75	978	56.84	1034.84	41.5	71	5.50	4200	17.75	745500	429458	.576			
25					1081	58.61	1139.61		73	5.35	4425		785437	472938	.602	.602	5.35	
26					1184	60.38	1244.38		88	4.44	5025		891937	516418	.578			
27	0.75	2.41	3.57	1.00	978	56.84	1034.84	41.5	58	6.74	4025	17.75	714437	429458	.601	.609	5.75	
28					1081	58.61	1139.61		64	6.10	4420		784550	470938	.602			
29					1184	60.38	1244.38		68	5.75	4775		847562	516418	.609			
30					1287	64.74	1351.74		83	4.71	5325		945187	560972	.593			
31	0.75	2.41	3.57	1.25	978	56.84	1034.84	41.5	50	7.82	4075	17.75	723312	429458	.595			
32					1081	58.61	1139.61		58	6.74	4350		772125	472938	.611			
33					1184	60.38	1244.38		62	6.30	4750		843125	516418	.612			
34					1390	69.11	1459.11		67	5.84	5400		958500	605531	.631	.631	5.84	
35					1493	73.48	1566.48		77	5.07	6000		1065000	650089	.610			
36	0.75	2.41	3.57	1.50	1390	69.11	1459.11	41.5	45	8.70	5300	17.75	940750	605531	.643			
37					1493	73.48	1566.48		48	8.14	5700		1011750	650089	.642			
38					1596	77.85	1673.85		51	7.66	6050		1073875	694643	.646			
39					1699	82.22	1781.22		55	7.10	6450		1144875	739198	.645			
40					1802	86.59	1888.59		57	6.86	6760		1199900	783675	.653	.653	6.86	
41					1905	90.96	1295.96		63	6.20	7225		1282437	823323	.645			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

An examination of the allegations made under the signature of "Justice," *respecting the patents for a Percussion Cannon Lock, obtained by Joshua Shaw, and by Lieutenant Bell.—By* Joshua Shaw.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—In the Journal of the Franklin Institute, May, 1831, I find a reply to my observations touching the conduct of Lieut. W. H. Bell, in relation to a patent taken out by that gentleman for a percussion cannon lock, &c. signed "Justice," which I think I shall be able to prove, in the course of the following remarks, to have been a most unappropriate title. In commenting upon this gratuitous article, I will not, in imitation of this *friend in need*, attempt to divert attention from the main question, by statements not the less mischievous, because told with apparent simplicity and truth; and which, until refuted, might be supposed to furnish a direct disproval of my general charges against Lieut. Bell. If, in making them, I have not been sufficiently explicit, I will now repeat them in more definite terms. I said that Lieut. Bell had infringed my patent right, and I now further say, that he has compromised the good faith, and violated the pledge of the government of the United States towards me, notwithstanding he "*belongs to a profession which tolerates no dishonourable conduct in any of its members.*"

It is easy to make charges and quite as easy to deny them, and little room may be required for either, except where the statements controverted require to be supported by reference to veritable documents, which, under present circumstances, it is indispensable upon me to do; but I will be as brief as possible, touching only upon those statements which may seem, until analysed, to refute my imputations against Lieut. Bell.

In the first place, Justice states that Lieut. Bell, is "*now absent at a remote station, where he may not, for a long time, meet with these foul aspersions on his character.*" It is believed that the Lieutenant, at the time the No. containing my charges against him appeared, was in Norfolk, Virginia; was, about the time his defence was undertaken, in Washington, on his way to Philadelphia; and was shortly afterwards, and is now, stationed at the Delaware Breakwater.—Secondly, Justice says, "that Lieut. Bell applied to me," *as a manufacturer of percussion primers, to procure a number of these articles, made according to a particular pattern, but which he did not obtain.* But why he did not, is not mentioned; at the proper time I may explain the secret, although I do not conceive it important to the point in question. In continuance he says, "*this occasion was certainly the first*, and it is believed the only one, *on which Lieut. Bell ever saw Mr. Shaw.*" This I assent to, and beg particular attention to the words Justice has marked in italics, as claiming especial notice; this meeting, we are told, occurred on the 18th day of April, 1829—this is indeed valuable information to me, as it fixes the time, and furnishes data very important should this dispute be ever argued in a court of law, should such evidence be there deemed admissible; it is indeed a two edged sword put into my hands, as I shall hereafter show the inconsistency of this visit of Lieut. Bell.

It is further said by JUSTICE, that "*the instrument for which Lieut. Bell has obtained a patent, was made and applied in the manner directed in his specification on, or before, the* 13*th of October*, 1828, *more than seven months prior to the interview with Mr. Shaw.*" That "*the merits of the instrument were successfully demonstrated on that day, and the trial of it was continued on subsequent days, for several weeks, and until it had fired a cannon one thousand times,*" *&c.*

It does not perhaps occur to the reader how convenient in this stage of the dispute it was for the gentleman to call the lock and its appendages an instrument, in place of an invention;—an instrument cannot be patented without it be capable of some new employment or useful purpose,—the principle was known and discovered by myself, the instrument was only employed to produce the effect, and this was the view taken by the Board of Ordnance, as will appear from a letter to me, from Col. J. Bomford, President of the Board, bearing date October 8th, 1824, and which I shall give verbatim before I close this article. I repeat that it was a happy expedient to call it an instrument, and keep out of sight any other term, as if the merits rested alone upon the lock, rather than the combinations and materials acting in concert with it. I have innumerable evidences in my possession signed Col. Geo. Bomford, authorized by the Secretary at War, which go to prove that the mode of acting upon the primer was not viewed as material, the object was to effect it by the simplest possible means; by a hammer, for example, if found convenient, and which might be retained in the hand. And the letters referred to go to prove that the authorities at Washington viewed the whole affair in this light; they solicit my confidence, and assure me that they admit the value of my discovery, and that in obtaining possession of all the necessary information, and *instruments*, which I placed at their disposal, their only object was to determine for themselves, by actual experiment, the best mode of applying the principle, and then to afford *me* the advantages of these results, as the effect of my invention.

JUSTICE has said that Lieut. Bell had determined in practice the merits of his instrument, more than seven months prior to his call upon me for primers, and that he actually fired it a thousand times, and, of course, had used 1000 primers; how happened it, if Lieut. Bell could furnish himself with 1000 primers, that he should call on me for so small a quantity as three or four hundred, for it must be observed, that the primer and its application, is, as it were, the essence, and constitutes one of the principal merits of the invention. Now, if he could supply himself with the larger, surely he could have supplied the smaller quantity. It is also stated, that there is one material difference between the two instruments, meaning mine and Lieut. Bell's, which is, that when applied to "*the purposes for which both are alike designed*, the one never fails, the other never succeeds." Really any person who had a spark of modesty, or reford is at present absent from the city, but before his departure he instructed me to inform you that he was desirous of giving a further and more extensive trial to your percussion primers for cannon, and for this purpose wishes to obtain a considerable number of them, say 1000 at least. From trials already made, strong hopes are entertained that the results will be satisfactory. As a preliminary, however, to the adoption of this method of firing cannon, the department must possess the means of making the primers at the arsenals. It is therefore proposed to you to furnish a machine, with all the necessary directions for making the primers, together with a small supply of the primers made by yourself, and a suitable lock for firing them, for all which the department will pay whatever may be a reasonable compensation for your time, services, and expenses, provided the whole amount shall not exceed three hundred dollars.

If you accede to this proposition, *the machine, and other means which you may furnish*, will be received by the department *under a pledge* that they shall be used *for no other purpose than that of making experiments to test their value and usefulness in service.* If, after a sufficient trial, it shall be determined to adopt the primers, the department will then enter into such further agreement with you, as may be satisfactory to both parties. You will perceive that the above proposition calls for nothing more than possession of the *requisite means* for ascertaining the real merits of the invention, with a view to its adoption or rejection, as the case may be.

Respectfully, I am, Sir,
Your ob'nt serv't,

W. Wade,
Captain on Ordnance Duty.

Now, if this was the only letter explaining the nature of the assurances made to me, some doubts might perhaps exist as to the full extent and meaning of the letter here given; but as I have numerous others, all tending to show, that it was not the *instrument*, but the *invention*, taken as a whole, that was valuable, and which my patent either does or was intended to cover, and also showing that the sole object of the Board was to vary the experiments, with such means, and aided by such information, as I could suggest, until they should be able to *adopt or reject it.* I solemnly declare that I did, at least nine or twelve months, before Lieut. Bell called upon me, inform Col. Bomford, verbally, of what I had invented in respect to *clearing the ventfield of all obstruction.* Indeed I had calculated upon this improvement from the first moment, and if any one will examine my specification, they will find positive evidence of it; I quote the passage I allude to; it is in the third division of the specification; having described the lock, as adopted by the Navy Commissioners, I go on to state, that amongst other advantages and modifications, that it can be so changed or modified, *as to leave the sighting and the ventfield clear.* This patent was secured on the 24th day of October, 1828, and will tend to prove that the very materials and information which I had furnished, and which were to be experimented on, as it were in trust for me, under pledges, the nature and bearings of which cannot be misunderstood, was insidiously taken away from me, and is placed to the account of Lieut. W. H. Bell. Now, it must appear that this friend was really unacquainted with all the particulars which he pretended to understand, or was determined to conceal material facts. In *any* case, his statements are an aggravation of the wrong already inflicted upon me; and if the latter motive prevailed, he has identified himself with the guilty party.

The following is a copy of a short letter received from Commodore Bainbridge:

Mr. Shaw having invented a Percussion Cannon Lock, and exhibited the same for experiment at this yard, which experiment was satisfactorily made in the presence of myself and several officers of the navy; and the lock, by recommendation, adopted in our naval service, as being very superior to any cannon lock heretofore used: since then, Mr. Shaw has made an improvement on his first lock, and it is now probably as perfect as a thing of that kind can be made.

(Signed,) Wm. Bainbridge.

Dated at the Navy Yard, Philadelphia, 15th April, 1829.

On the 7th January, 1831, a Military Committee, appointed by Congress, made a report respecting an application of mine, the purport of which is not material here; but there is a passage in it, which I shall quote, that has an immediate bearing upon the present question. It runs thus:

"It appeared to the Committee, by the concurrent testimony of officers of the highest respectability in the navy and the army of the United States, that the memorialist had not overrated his merits, and that he was justly entitled to the reputation of great ingenuity, judiciously applied to an important military object," &c.

I now submit it to a candid public, whether I have, or have not, sustained my charges against Lieut. Bell? and also, whether Justice, who says it is the duty of a friend, "*to whom all the material facts of the case are known, to lay a brief statement of them before the readers of the Journal,*" has, or has not told the truth, the whole truth, and nothing but the truth.

Should Justice think proper to make any rejoinder, it will be necessary for him to do so under the sanction of his proper name; as I shall not, hereafter, reply to any charges, or attack any defences, set up by an anonymous writer.

I remain, Sir, yours,

Joshua Shaw.

Philadelphia, July, 1831.

Remarks by the Editor.—This Journal is intended for the promotion of general information; in endeavouring to attain this end, individuals will sometimes feel themselves aggrieved, and will have some just claim to be heard through the medium of our pages. So long as a discussion is calculated to unfold the truths of science, it may be legitimately continued, if not too much wiredrawn; when, however, the dispute becomes merely personal, and is incapable of adjustment excepting by a court and jury, the public will cease to partake of that interest with which the combatants may be animated, and it is then time to seek a new arena. Such, we think, is the state of the present contest. Common courtesy, however, demands that Lieut. Bell, or his friend, Justice, should be heard in reply to the preceding. But, let it be remembered, that "brevity is the soul of wit."

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Oiling Rail-way Carriages.

Sir,—There is no difficulty in oiling axles continually, but to do it so as not to waste a drop of oil, has not been done, I believe, till the latest improvements in the friction saving carriage of the Baltimore rail-road, where very accurate experiments have been making by Mr. Geo. Brown, one of the principal proprietors in that work; the result of which, he informs me, is, that one quart of oil will be sufficient for 2000 miles run of a carriage, which, with its load, weighs three tons. He informs me at the same time, that he has ascertained, that the Lehigh rail-way carriages consume four quarts in running 821 miles with one ton. This you will perceive is nearly *thirty times as much.*

The manner of oiling the Winan's wagon is peculiar to its construction as now improved. The secondary wheels now run in a cast iron case, the top of which is formed so as to affix to the under surface of the side timbers of the frame of the wagon. Its sides sustain the axle and are supported or joined by an intermediate part or bottom, which forms a tight case, into which the oil is put, so that the friction wheel dips into it, and its rim carries up a little of it continually to the rubbing and rolling surfaces, returning it to the reservoir; thus oiling its own axle where all the rubbing is situated, and the rolling axle, and no more is *consumed* than *evaporates.* Its enclosure keeps it clean.

I need not remind you that the use of oil on axles is not only to keep the surfaces from absolute contact, and grinding together, but to keep them cool, and this is better done by the successive application of new portions of oil, than by keeping the same oil on the axle as long as it will last, partaking of the heat the axle acquires, and therefore evaporating the faster. This method must therefore be of consequence when great velocity is to be given to heavy loads.

Respectfully, yours, &c.

J. L. Sullivan.

FRANKLIN INSTITUTE.

Monthly Meeting.

At a stated monthly meeting of the Franklin Institute, held at their Hall, July 28th, 1831.

THOMAS FLETCHER, Esq. Vice President, in the chair, and
ALGERNON S. ROBERTS, Secretary, *pro. tem.*

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute.

By Mr. Robert S. Gilbert.

The Cabinet of Natural History and American Rural Sports.

By Messrs. Carey & Hart.

The Working Man's Companion. The Results of Machinery, namely, Cheap Production and Increased Employment exhibited; being an Address to the Working Men of Great Britain.

The corresponding secretary laid upon the table the following works received in exchange for the Journal of the Institute—

London Journal of Arts and Sciences, for June.

The Repertory of Patent Inventions, for April and June.

London Mechanics' Magazine, for May.

The Register of Arts and Journal of Patent Inventions, for April and June.

Recueil Industriel, for February.

Bibliothéque Physico-economique, for April.

Annales de Chimie et de Physique, for January.

North American Review, for July.

American Annals of Education and Instruction, for July.

Museum of Foreign Literature, Science, and Arts, for July.

American Journal of Geology and Natural Science, for July.

The Illinois Monthly Magazine, for June.

The committee on Inventions presented a report on D. L. Smith's planeing machine, which was read, and, on motion, referred to the committee on publication.

On motion, the subject proposed for discussion this evening was postponed until the next monthly meeting, and then adjourned.

THOMAS FLETCHER, *Vice President.*

ALGERNON S. ROBERTS, *Sec. P. T.*

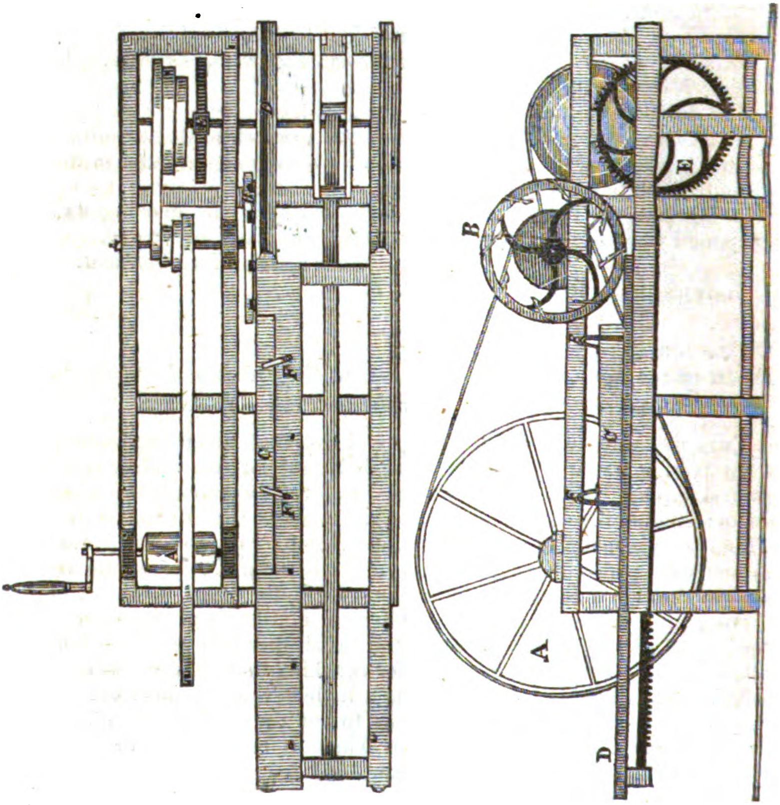
Report of the Committee on Inventions, of the Franklin Institute, on DANIEL L. SMITH'S *Revolving Timber Plane.*

THIS machine, of which drawings and explanations are appended, consists of a frame of sufficient length to support the timber to be planed, having a sliding carriage upon it moved by a rack and pinion, on metal guides, upon which the timber is secured by hold-fasts. This frame is made to pass before the face of a cast iron wheel, furnished with plane irons, which revolves with rapidity, receiving its motion through a strap from a belt wheel in the hand machine, or driving pulley; the rack pinion taking its motion from the shaft of the plane wheel. On the face of the cast iron wheel are fixed four plane irons. Two of them single for roughing down the work, each followed by a double iron projecting a little beyond the first pair for finishing, all carefully adjusted so as to cut the face of the timber exactly square with the carriage on which it rests. The roughing irons extend further from the centre of the wheel than the other pair, and their ends made round with cutting edges to enable them to take off any projections on the wood which could not be removed by the faces, and reduces the wood, at one operation, to the full breadth of the iron, say from half an inch to one inch. To cut the timber to any bevel it must be set on the frame to the required angle, and secured by wedges on the outside.

This machine differs from Woodworth's, inasmuch as the cutters are secured to the face of the wheel, instead of the periphery, and is not furnished with secondary planes for tongueing and grooving.

The committee witnessed several trials on a model which was laid before them, and afterwards on a large machine in Kensington, where it performed its work with expedition and accuracy—the timber was square maple and cherry, from which the irons at once cut a chip three-fourths of an inch thick. As the cutters move across the grain of the wood, it is probable that unless the edges are kept exceedingly sharp, smooth work could not be performed on soft spongy wood, but they recommend it as a valuable addition to the machine maker's shop, or to others who work in the harder woods.

Philadelphia, August 25, 1831.



AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1831.

With Remarks and Exemplifications, by the Editor.

[* Continued from p. 127.]

55. For an improvement in the *Grist Mill,* called a self-stopper; Robert M'Cormick, Jr., Augusta county, Virginia, April 20.

Within the ordinary hopper, there is a secondary, or false hopper, exactly fitting the former on every side; this false hopper is placed at the lower part of the true one, and may extend up, probably, one-third of its height. The false hopper is attached to a cord, which passes over a pulley with a weight sufficient to raise it when not held down by the grain within it. When nearly all the grain has run out of the hopper, the weight descends, and by a connexion established between it and the gate arm, stops the mill.

The claim is to "the false hopper, the lever, &c. by which it is suspended, the weight, as constructed, and the channel in which it plays up and down; the horizontal rod as connected to the shoe, and the combination of the several parts."

---

56. For a *Washing Machine;* John Hale, Hollis, Hillsborough county, New Hampshire, April 20.

We really believe this to be a washing machine of a new construction, which, numerous as are the patents taken for such instruments, is a thing of rare occurrence. A washing tub is to be made in the form of the troughs of those mills for grinding apples, bark, and other articles, in which a stone rolls round. In other words, take a tub three and a half feet in diameter, and another of two feet in diameter, place the last within the other, bottom upwards, and you have the form of the annular washing tub described in the specification. A vertical shaft is to pass through the centre of this tub, and to be supported by pivots, in a proper frame, so that the tub will revolve freely in a horizontal direction. A roller of 18 inches in diameter is fixed upon a shaft in the frame, and when turned by a crank it revolves within the annulus, or circular trough, touching its bottom. This roller is the frustrum of a cone, to which the bottom of the trough is adapted to cause it to act regularly. The lower pivot of the main shaft rests upon a moveable lever, under the tub, and is sustained by a weight, or spring, to allow the tub, as it revolves, to adapt itself to the varying thickness of the clothes. The motion is to be slow, to effect which a pinion on the crank shaft takes into a wheel on the shaft of the roller.

The claims are to "the annular form of the tub, with its advantages of rising and lowering according to the irregular thickness of the clothes spread therein to be washed; and the advantages obtained by the speed of the washer, which facilitates the operation."

57. For an *Upright Toggle-joint Press;* John Hale, Hollis, Hillsborough county, New Hampshire, April 20.

This is a standing press, with a bed piece, cheeks, and caps, made in the usual manner. There are two toggle-joints attached by their upper ends to the cap piece, and by their lower ends to the platten, or follower, the knees of the joints receding from each other: when in use they are to be drawn together by a rope, for which purpose they have sheaves fixed in the joint pieces, running upon pins within mortices made in them; through these a rope is reeved. A windlass attached to one of the cheeks of the press is used to draw this rope. The claim is to the application of the several pulleys, or sheaves, to the toggle-joints; and the application of ropes."

There are but very few objects to which such a press is applicable. The toggle-joint being peculiarly adapted only to the purpose of traversing a small distance, with the exertion of immense power at the end of its short range. Where goods are to be pressed the conditions are very different, and such as this press will not fulfil.

---

58. For a *Polishing and Graining Machine,* for Morocco and other leather; Robert Emes, Boston, Massachusetts, April 20.

A wheel, which may be of iron, and eleven feet in diameter, is made to revolve upon gudgeons, like a fly wheel; a stout base, or foundation of stone, lies under this wheel, a part of it being cut into the form of a segment suiting the diameter of the wheel. This part may be faced with iron, and forms the bed upon which the leather is to lie, in order to its being diced, or polished. The flints for polishing, or the blocks for dicing, are fixed upon six rods upon the periphery of the wheel; these rods slide in sockets so that they can retreat, and are borne out by spiral springs, that the requisite pressure may be made upon the leather.

"What I claim herein as new, and of my own invention, is the wheel aforesaid, with the apparatus thereto fixed when applied for holding and carrying a flint polisher, and operating therewith on morocco, or other leather, to polish the same, and for holding and carrying a dicing ball or block, and operating therewith upon morocco or other leather, to dice or grain the same, and the flint when used and applied as aforesaid, with the said wheel and its apparatus for holding the same, for the polishing of morocco and other leather."

At p. 200, vol. 3, there is an account of a similar machine, patented by Abel Bayrd, of South Reading, Massachusetts, on the 29th of December, 1828. If there is any thing different in the principle of the two machines, we are unable to discover in what this difference consists. The last mentioned patentee refers to one obtained by Mr. Jacob Perkins, in the year 1809, for the same purpose, which he in part adopted, taking his patent for an improvement thereon.

---

59. For a *new Material for Sheaves of Blocks;* Caleb Curtis and Thomas C. Smith, Boston, Massachusetts, April 20.

"The stone ware sheave, made of clay, and the materials usually employed in the glazing of stone ware, pottery, or glass ware, to be used in the same manner and for the same purposes as lignumvitæ and iron sheaves are now used."

These sheaves are undoubtedly very good, when well made; this, we believe, has been proved in England; as we recollect sometime since, seeing them mentioned in one of the journals; although this fact may militate against the validity of the patent, it will not affect the goodness of the pulley.

---

60. For a *Churn;* David Smith, near Emmitsburg, Frederic county, Maryland, April 21.

A trough is made, the excavation in which is to be semi-cylindrical. In this trough dashers are to revolve backward and forward, they being fixed upon an axle for that purpose. A cover is to be keyed down over the dashers, to prevent the waste of cream. It is to be worked by a lever, there being a pinion on the dasher shaft, and a segment of a wheel on the fulcrum of the lever. The claim is to "*the mode of keying the top to the bottom;* the inclined dashers, and the mode of working them."

---

61. For an *Improvement in the Power Loom;* Jesse Taylor and Joseph Woodhead, Middletown, Pennsylvania, April 21.

The exact structure of the part patented, cannot be given without a drawing; but its object and operation are thus explained:

"When the thread of the filling or weft breaks, the spring acts by the lathe's striking against the breast beam, and the finger [a part so called] pressing on the lever, lets off the gearing rod, and suffers it to slide along the mortice; it then throws the strap from a fixed to a loose pulley; thus stopping the operation of the weaving."

The claim is to the "stopping of the power loom when the filling breaks, by the machinery itself, without the aid of hand."

---

62. For an *Improvement in Tanning;* Isaac Daws, Goshen farm, Montgomery county, Maryland, April 21.

The directions given are, after the hides have been haired and fleshed, to hang them in bates, upon pegs or nails, very close together, until fit to work in the bark: clean and rince them, hang them in tan vats upon pegs or nails, in a weak sour liquor, for two or three days; hang them next in a stronger liquor for four or five days. Make a very strong liquor of black oak bark; for a vat of thirty hides, add one pound of Glauber's or other salt; add three bushels of bark at the bottom, and one at the top of the vat; in this hang the hides for three weeks, covering the vats up to prevent evaporation.

On removing the hides, the liquids will answer as weak liquids.

The claim is to the foregoing process, by which leather can be tanned in less time, with less labour, and be equally good with that tanned in the ordinary way.

---

63. For a *Washing Machine;* John G. Conser, Miles township, Centre county, Pennsylvania, April 21.

There is no claim to this machine; and it is so old fashioned, that we have met with it repeatedly, and do not, from our acquaintance with it, think it worth introducing again to our friends.

---

64. For an improvement in *Teaching the Art of Performing on the Violin;* Robert M'Cormick, Augusta county, Virginia, April 21.

Not being adepts in music, we will not attempt a particular analysis of the merits of the plan before us. The specification refers to three musical scales, which are delineated in it, and which we do not think it necessary to give. These scales are to be let into the finger board, by dovetails. They have frets across them at each semitone, so that when the string is pressed by the finger, it is stopped by the fret, as in some guitars, a little variation of the finger not affecting the note. These scales may be changed. One of them is for pieces keyed on D major. One on the minor scale, and the other for pieces on C major.

Besides these scales, there is what is called a tuning scale, or block, which is to be slipped into the place prepared for the scales. It has projections rising on it with notches to receive the strings alternately. The object, if we understand the description, is to stop the string at such a part as shall enable the performer to tune it, by making it sound the same note with the preceding string. Thus, when the treble, or E string, is raised to the desired height, the second, or A string, is placed in the notch intended for it, and strained till it produces the same sound with the treble, and so on.

The claim is to the three main scales, and the tuning scale, or block.

---

65. For a *Thrashing Machine;* Andrew Richison, New Carlisle, Clark county, Ohio, April 22.

This thrashing machine has a cylinder and concave of the ordinary construction. As the straw passes from the concave, it is taken hold of by a revolving rake, with four arms, and teeth on cross pieces, the grain falling out underneath.

"The *invention* here claimed, is the construction and arrangement of the several parts of the machine; but particularly the mode, before described, whereby the grain is separated from the straw, and the latter thrown out by the revolving rake."

Should nothing be retained, either in general, or in particular, but what is new, the remaining part of this machine would occupy a very small space.

---

66. For an improvement in *Horse Shoes;* John Dietz, city of New York, April 22.

The shoe is to be made bevelling from the inner towards the outer edge, and is to be considerably thicker than ordinary.

"By this method of construction, the shoe is prevented from clogging with ice or snow; and being of a uniform thickness, sets easier to the foot of the animal, and on account of the pressure being equal on all sides, is far more durable than the common horse shoe."

Instead of a groove for the nail heads, countersinks are made, and nails suiting them pass in flush.

---

67. For an improvement in the *Horizontal Square Piano Forte;* Ebenezer R. Curcier, Boston, Massachusetts, April 22.

The objects claimed to have been accomplished by this improvement are the following: The making each hammer strike one or more strings, as in the grand piano forte; for which purpose the hammer rail is made to shift by means of a pedal. The placing the key board exactly midway of the instrument, giving a compass of seven octaves, and preserving greater symmetry and beauty than by the ordinary arrangement. The running of the braces very near to the strings, thus attaining great strength and lightness, with the property of keeping in tune.

As these advantages depend principally upon the arrangement of the action, a drawing would be necessary to their explanation.

---

68. For the application of power to the *Extracting of Stumps of Trees;* Willard Foster, Oswego, Tioga county, New York, April 22.

A straight post of about nine feet in length, with a cross piece of timber morticed on to its lower end, to prevent it from sinking into the ground, is placed at the distance of about two feet from the stump to be raised; its upper end is to incline so as to stand over the stump. A chain, one end of which is firmly attached to the stump, passes over, and rests upon the upper end of the post first mentioned; the other end of the chain is to be fastened round another stump, or any convenient fixed object. If this chain be then shortened by any means, and all the attachments be secure, the stump will be raised. This shortening is proposed to be effected by means of a tackle attached to the chain, drawing it laterally; or by means of a long lever with chain and hooks near to one end of it, which hooks may be so attached to the main chain, that by twisting the lever it may draw forcibly upon them.

There is no claim made, but we are told that "the power may be applied to extracting stumps, raising weights, drawing up vessels, moving buildings or other ponderous bodies, and such part of the machine, or the whole, applied, as will effect the object."

As no new power, or machine, is brought into action, but means resorted to which have been heretofore applied in various ways, we presume it would have been best to have confined the description to the raising of stumps, because it is probable that such part as has been heretofore employed for other purposes, may still be freely used.

---

69. For an *Ink Holder;* Daniel Harrington, Philadelphia, Pennsylvania, April 22.

This is an ingenious contrivance for regulating the height at which the ink shall stand in the vessel containing it, and for securing certain other advantages; as this ink holder consists of several parts, tending to the attainment of the same ends, its structure cannot be fully explained without the aid of a drawing.

The ink is contained in a cylindrical chamber, in the part which may be denominated the ink stand. A second chamber is provided into which the ink is to flow from the first, there being a lateral opening from one into the other. A cylindrical cup, or box, screws into the first chamber, and may be readily made to press upon the surface of the ink below it. When depressed, the ink rises in the second chamber, and when raised, the ink in this second chamber is depressed, and it is evident that its height may be thus regulated. Another cylindrical cup screws into the second chamber, which is also capable of being raised or lowered as desired. Into this cup the pen is to be dipped. A disk of cork is placed within it, against which the end of the pen is to touch, preserving it by its texture from any injury.

---

70. For *Cast and Wrought Iron Mill Spindles, and a Cast Iron Driver;* James Barton, Milford, Pike county, Pennsylvania, April 23.

"The improvement in the cast iron mill spindle consists in casting it with a square or round hole in the bottom of the spindle, about three inches in depth, into which is to be inserted a cast iron, or wrought iron and steel foot, on which the spindle turns. The length of this point or foot is about seven inches, and it is to be so fashioned as easily to slip in and out." "The improvement in the wrought iron spindle is similar to the cast iron above described, having a hole punched in the bottom into which is to be inserted a cast iron, or wrought iron and steel point or foot that may be put in or taken out at pleasure."

Under the drivers there is to be a collar of cast iron, about five inches long, and four and a quarter in diameter. It is to be slipped on a square upon the spindle, and rests upon a shoulder prepared for it. The driver, resting upon the collar, is to be of cast iron.

---

71. For a *Machine for giving Motion or Exercise to Invalids,* in their own Rooms; Daniel Harrington, city of Philadelphia, April 23.

The general form of this instrument, or machine, may be that of a sofa, arm chair, or other kind of seat, or lounge. These may be placed upon rockers, similar to those of rocking chairs. The seat of the chair, or other vehicle, instead of being supported, and connected to the rockers by legs, are sustained upon springs; which are usually of an elliptical form, or that of a double bow; there is a series of these springs, one above the other, and properly connected by their middles. They may be hidden by drapery, and the whole apparatus assume an elegant appearance. The number of pairs of springs may vary, but from three to five on each side will operate most agreeably.

The invention claimed is to the application of springs to a health vehicle, for the purposes described; these springs may be varied in form; grass-hopper springs, straight springs, connected in a proper manner, and others may be employed for the same purpose.

The vehicle may be moved by the invalid; or when necessary, the motion may be given by an attendant, and the force of it may be regulated according to circumstances, so as to imitate the exercises of walking, trotting, or galloping.

---

72. For a *Machine for separating Gold from Earth*, and other substances, being an improvement on the Rocker and inclined Plane; Green B. Palmer, Burke county, North Carolina, April 23.

"As to my claims of the improvement on the rocker, they are—

"1st. Forming the rocker, containing perforated iron plates in such a way, that the sand, gravel, &c. can then be thrown in at the upper end by moving the handle, or lever, from the head to the middle, or elsewhere, so as to be out of the way of the workman at the head.

"2nd. Putting into the rocker, underneath the perforated iron plates, inclined planes, with bars or stops across them, so as to detain quicksilver, and so constructed that the whole must be in constant motion, together with the earth, sand, water, quicksilver, gold, &c.

"3d. The invention of the lever and knocker in the middle, so as to strike on the springs at each vibration.

"4th. Poising the machine on pivots, points, or gudgeons, so as to support the weight.

"5th. The process of locking in, either by bars across the perforated iron plates, or as a drawer at the head.

"6th. The principle of the motion used in the inclined plane beneath the perforated plates, for fanning out."

"7th. The principle of the spring on which the jarer, or knocker, works.

"8th. The improvement of the inclined plane, or riflers, with stops across them, from the notched log, or gutter."

We have given no more than the claims to the foregoing machine. The whole specification is of considerable length, and would not be intelligible alone, or interesting to many of our readers.

---

73. For an improvement on the machine for *Splitting Leather;* Alpha Richardson, Boston, Massachusetts, April 23.

This is an improvement upon "Parker's machine." It is one of those which would require a plate for its illustration. We are told that "all the improvements are clearly and distinctly shown on the *accompanying model.*" The proper place is the *accompanying drawing*, when the law is taken as a guide.

74. For an improvement in the process of *Dressing Woollen Cloths*, and cloths composed partly of wool, and partly of cotton; Calvin W. Cook, Lowell, Middlesex county, Massachusetts, April 23.

(See specification.)

75. For an improvement in *Rail-road Carriages;* William Howard, Civil Engineer, Baltimore, Maryland, April 23.

(See specification at p. 391 of the last volume.)

76. For a machine for *Thrashing Grain and Clover*, mashing and grinding grain, and for hulling and smutting it; Orange Dean, Jr., and Joseph Woodhull, Caladonia, Livingston county, New York, April 25.

The cylinder of this machine is to be covered with plates of cast or wrought iron, having teeth upon them, resembling saw teeth. The concave is to surround the cylinder, for one-half of its circumference. The teeth of the cylinder are not to reach within three inches of its ends, and curves of wood are to be fitted to these smooth parts; sustaining the hollow segment at a due distance from the cylinder. The concave, instead of teeth, is to be furnished with vertical grooves. A vibratory motion is to be given to the cylinder; this is to be effected by means of a wheel on the shaft of the cylinder, which has on it a zigzag groove, or fillet, which serves to guide a lever connected with the concave, to which it communicates a motion of about two inches backwards and forwards, lengthwise of the cylinder. For clover seed, the teeth and grooves are to be smaller than for grain.

When used for mashing or grinding, hulling or smutting, the concave is to contain teeth instead of grooves. Sieves, screens, &c. may be added, and shaken by the zigzag.

The claim is to the principle of the lateral, or backward and forward, movement; and to the other parts which, though not new in themselves, are new in their general arrangement.

It seems to us that what is here patented can scarcely be called *a machine*, but is rather two or more machines, as when used for the different purposes designated, the same instrument will not answer the intention; but parts, if not the whole of it, have to be changed. If the same machine would apply to all the purposes designated, a patent for the machine might legitimately include its application to the whole of them.

77. For *Dogs for Saw Mills;* Anson Andrews, Spencer, Tioga county, New York, April 26.

The patentee says, "What I claim as my improvement is the manner of shifting the gauge dog on the square bar, and the manner in which it is made, also the screw that passes through the eye against the end of the bar, to shift the bar to the exact thickness of the lumber; also the dog that holds the log on the other end of the tail block, through which passes an angle dog, together with the hand that is fixed on the upright part of the half bail, and the manner of lengthening and shortening it."

There is a drawing, but it is without "written references."

By turning back to our list of patents for 1830, it will be seen that four patents were granted in the course of three weeks for dogs for saw mills. One on the 19th of February, one on the 10th of April, and two on the 13th of April. That on the 10th of April was obtained by the same person to whom the above has issued. The claims in both cases are so similar, as to make it appear that some of those points now claimed were included in the patent of last year, which is altogether inadmissible, as there cannot be two valid patents for the same thing. The present, we apprehend, should have been taken for an improvement, merely, on the former patent.

---

78. For a *Thrashing Machine;* Joshua S. West, Portland, Chataque county, New York, April 26.

The "cylinder" and concave meet us, as usual, with this difference, that the *cylinder* is a *cone*, or rather, is made conical, its diameter at one end being an inch greater than at the other. Bars of iron pass from end to end of it, running spirally.

"To this machine is added a hopper, or feeder, which receives English grain in loose bunches, the heads of the grain at the largest extremity of the cylinder, and the butts of the straw at the smallest extremity. As the cylinder is tapering, and the bars of iron on it run spirally, the straw passes through quartering, in consequence of which the machine clears itself light and easy, and does not become choked as is the case with machines where the straw passes through endwise."

There is no claim made, yet certainly the whole machine is not new. The conical form of the "cylinder," we believe to be so.

---

79. For a *machine for Thrashing Grain*, shelling corn, and grinding apples; Alonzo L. Smith, Weedsport, Cayuga county, New York, April 27.

This machine, which is to fulfil three several purposes, is in fact three several machines, for which one common frame will answer, and which may be driven by the same motive power. There is a thrashing cylinder, with twisted iron bar beaters, and a concave bed. Another cylinder, set with teeth in the old fashioned way, for shelling corn, and a concave bed, with a spring, against which it is to operate. A third cylinder, and its bed, are set with teeth, for grinding apples.

In the corn shelling machine the claim is to "the shape, form, action, and, finally, all its most essential parts."

"In the grinding apples, all except the teeth, the shape of the cylinder, and its being propelled by horse power."

"In the grain thrashing part, all except the use of square bars in the bed, shape of the cylinder, and manner of propelling. And, further, the great advantage of *one* machine answering three purposes." There is certainly some mystery in forming one machine of three.

80. For a *Thrashing Machine;* Edmund Warren, city of New York, April 27.

The cylinder is to be banded with iron from end to end, and is to have teeth; the concave is to be like other concaves; the frame supporting the cylinder is in the form of an equilateral triangle, resting on one of its sides; the claim is to "the wrought iron hooped cylinder with spurs; the particular form of the frame, to give great strength with little expense or workmanship; as also the inclined springs for the concave, with the mode of changing them by screws, for corn."

81. For a *Saw Trimmer;* John R. Failing and Robert G. Nellis, Canajoharie, Montgomery county, New York, April 27.

This is a machine for what is sometimes called gumming saws. It is merely a steel punch, sliding in a socket, with a bed below it, upon which the saw is to be laid. When used it is to be placed upon an anvil, or other solid body.

Which of our mechanists will point out the novelty of this invention? The saw maker certainly will not.

The claim is to the exclusive privilege of using this machine.

82. For a machine for cutting or *shaving Smoked Beef or Cold Slaw;* Henry Bangs, city of New York, April 27.

The old cutting knife and board, for cutting cold slaw, is to be fixed so that the edges of the board may slide up and down between two vertical posts. There is to be a piece of timber on which to rest the beef, or cabbage, and a box below to catch the cuttings. The claim is to the foregoing machine.

83. For a machine for *Dubbing, or Dressing, of Ship Timber,* knees, plank, &c.; John Judge, Navy Yard, Washington, District of Columbia, April 27.

The timber to be dressed is to be fastened on to a carriage by suitable screws. The carriage may be made to advance by means of a rack and pinion, like a saw mill carriage. A wheel, or wheels, with cutters, is made to revolve, by the application of any sufficient motive power. There may be two cutter wheels on the same shaft, one operating upon each side of the timber which is embraced between them. These may be adapted to any thickness of stuff by making them advance towards, or recede from, each other, by means of a screw on the shaft, or a groove and key, in ways well known to workmen.

The claim is to "the application of cutters on the periphery of wheels, to the hewing, dubbing, or dressing of ship timber, plank, knees, &c. &c., with the manner of fastening the timber to the carriages; and also the manner of adjusting the wheels to the different thicknesses of timber."

This is a machine well calculated to facilitate labour in the way designated; and to effect its purpose with much greater truth than is possible by hand. The patentee is a skilful workman at the Navy Yard in this city, who has introduced several valuable machines, and modes of procedure at that establishment, by which the public have been much benefitted; but, we believe, without that recompense to which his real merit justly entitles him, and which he probably would have obtained had he been out of the service.

---

84. For a self acting fulcrum, screw, or spiral lever, for *propelling Vessels, and Rail-road Carts*, &c. &c.; John James Giraud, city of Baltimore, Maryland, April 27.

(See specification.)

---

85. For a machine for *Gumming Saws;* Phineas Newton, Sidney, Delaware county, New York, April 29.

This machine consists of a lever with a long and short arm, the short arm forcing down a steel cutter upon a steel bed, the latter having an excavation adapted to the tooth, and the end of the cutter fitting into this excavation. There is no claim, nor any thing novel in its mode of operation. Besides the patent above noticed, for the same purpose we have previously recorded three or four others, all of them operated upon by levers. Why does not some one patent the application of the screw to gumming saws?

---

86. For a method of *Amalgamating and Washing Residuums, or the Gold and Silver Ore*, pulverized, or calcined, in their first state, to extract the gold or silver; James Lewis Montaudevert, Charlotte, Mechlenburg county, North Carolina, April 30.

The residuum of ore that has been ground, and, if necessary, calcined, is to have the metal which may have escaped the first amalgamation extracted by the process described.

The residuum after having been dried, is to be moistened with a portion of common salt, put into a wooden trough with quicksilver, and pounded. About ten per cent. of quicksilver will be required. The mass in the trough should not exceed four inches in depth.

To collect and unite the quicksilver, an iron or copper washer, like a soap boiler's kettle, is to be used. It must be of ten times the capacity of the residuum. This washer is to be placed over a furnace, a large surface being exposed to the action of the fire. It is to be nearly filled with water, which is to boil for thirty minutes. The quicksilver will be found in globules at the bottom, after the fire has been removed. The finer particles, which sometimes float, are to be beaten down by a shower of cold water, or by a spatula.

The fluid is to be drawn off into successive receivers, furnished with spouts like those of tea kettles, delivering it from one to the other. In these successive receivers the floating quicksilver is to settle; and the quicksilver collected from the washer, and the successive vessels, is to be used with other residuums, until it is sufficiently saturated with the gold or silver.

It is said that this process is more economical than those heretofore employed: that little or no quicksilver is lost, and residuums which would not bear an expensive process can consequently be used.

The washing with boiling water; the precipitation by a shower bath of cold water; the collecting the floating particles in successive receivers; the repeatedly using the same quicksilver until sufficiently saturated, and the application of the same process of washing, constitute the claims.

---

87. For an improvement upon a *Water Wheel for propelling Boats*, for which a patent was obtained on the 22nd day of December, 1818; Asa Waters, Millbury, Worcester county, Massachusetts, April 30.

The buckets are made to swivel upon pins on their ends, working in arms. There are cams for locking and unlocking them, the intention being that the buckets may "always strike the water at a proper angle for obtaining most power, and have no back water to raise; because, when the buckets are brought to a certain position or bearing in the water, the cams at the bottom of the wheel press on the levers and unlock the floats, and let them swing loose on their pivots; and at the same time the floats at the top are locked by the same means; thus producing a maximum of power in the wheel."

We have not heard that the wheel, as first patented, has been brought into successful operation; nor do we anticipate that with the improvements it will make its way as well as the common paddle wheel. We expect but little from swinging buckets in general.

---

88. For a *Thrashing Machine*, called the "twin cylinder and double concave thrashing machine;" William E. Osborn, Brighton, Monroe county, New York, April 30.

There are, as the name indicates, to be two cylinders and two concaves. The cylinders run close together, a line joining their axes forming an angle with the horizon, of about 45 degrees. The teeth in the cylinder, and the bars forming the beaters, are similar to some formerly patented, although they are here claimed as new. The two, or more cylinders, and concaves, are also claimed.

---

89. For a machine for *Grinding, Levelling, and Polishing Plates of Metal*, and other hard substances; William J. Stone, city of Washington, District of Columbia, April 30.

(See specification.)

LIST OF AMERICAN PATENTS WHICH ISSUED IN MAY, 1831.

With Remarks and Exemplifications, by the Editor.

1. For improvements on a machine formerly patented by Amos Whittemore, for *Cutting the Teeth, Pricking the Holes, and Setting the Teeth in Filleting Cards;* Reuben Meriam, Leicester, Worcester county, Massachusetts, May 2.

"The improvement consists in effecting the side motion of the carriage which holds the leather, in a more gentle and perfect manner, so that the operation may be greatly accelerated, and the machine at the same time be less liable to get out of order."

How this is to be accomplished we shall not attempt to describe, the complexity of the machine rendering any such attempt useless, excepting to those few who are perfectly acquainted with the structure of this ingenious instrument, as at present made.

---

2. For an improvement in *Distilling;* James L. Jenks, Sackett's Harbour, Jefferson county, New York, May 2.

(See specification, p. 321, of our last volume.)

---

3. For an *Apparatus to be connected with, and to form part of, a Steam Engine Boiler;* Philo C. Curtis, Utica, Oneida county, New York, May 3.

(See specification.)

---

4. For a machine for *Cutting Grass and Grain;* William Manning, Plainfield, Essex county, New Jersey, May 3.

(See specification.)

---

5. For an improvement in *Stoves to be heated by Stone Coal;* Urban B. A. Lange, city of Philadelphia, May 3.

The grate in which the coal is to be burnt, is not within the stove, but is connected to it by a horizontal flue leading into the lower part of it. The stove consists of several compartments, all of which are to be heated by the flue through which the heated air is to pass, such a direction being given to it as is adapted to the purpose.

The particular arrangement adopted is represented in the drawing. The claim is to "the construction of said stove, and the application of stone coal to heat the same."

---

6. For a *Machine for Grinding Bark;* Merrit Hurd, Augusta, Oneida county, New York, May 5.

This bark mill is not very distinctly described, but the patentee appears to consider it as new in nearly all its parts: he says, "I claim as my own invention all parts of the said machine except the teeth in the hoops;" these hoops we will presently describe. As represented in the drawing, most parts of this machine appear to resemble such as are well known, and have been long used.

The shaft stands vertically, in the usual manner, and carries a conical nut, furnished with teeth, for breaking the bark, which is contained within the surrounding rim. Below the conical part of the nut, it assumes a cylindrical form, and is furnished with teeth, as usual: this is the part called the hoop; it is to be made of cast iron, in segments, screwed on, and capable of being renewed, as the teeth wear out. This construction of the hoops is claimed as new.

---

7. For an improvement in the *Apparatus and Mode of Drawing Soda Water;* Justus Perkins, Brutus, Cayuga county, New York, May 3.

A vessel of tin or other material is to be made, and divided into two parts by a partition across. A cock is to be inserted into this vessel, the tube of which, behind the key, is to be divided into two parts by a partition corresponding with that of the vessel; one of the parts opening into one division, and the other into the opposite. When the key of the cock is turned, the fluid flows from each division, and the two portions unite in the common orifice of the cock.

The two parts are "the one to hold the soda, the other the tartaric acid," about which two articles nothing had been previously said; it would appear, therefore, that the patentee supposes that what is usually called soda water, is prepared from these two ingredients, whilst the fact is that neither of them, ordinarily, enters into its composition; the so called soda water, being merely water impregnated with carbonic acid. The liquid in question is one form of the well known effervescing mixture of the physician; citric acid, however, being most commonly used for this purpose. The liquid is in fact a solution of Tartrate of soda. The claim is to the apparatus employed.

"What I claim is the before described apparatus for, and mode of drawing soda water, by means of a compound cock or fasset."

---

8. For an "*improved Plantation Mill*" for grinding of Grain; John Anderson, Louisville, Jefferson county, Kentucky, May 3.

This patent is taken for making the husk, and the frame work, generally, of cast iron. "The inventor claims as new the application of this material (cast iron) in its various forms to this purpose, believing it to be exclusively his suggestion; and as better adapted to this purpose than any material hitherto used," &c.

Cast iron will undoubtedly make a solid frame work and foundation for such a mill; but whether the mere use of this material will prove to be as secure a foundation for a patent, may admit of doubt.

---

9. For *making Mould Candles* by means of a machine for supplying and cutting the wicks, and drawing the candles from the moulds; which he calls "The Candle Drawer, and Endless Wick Nipper; Thomas Hewitt, jr. city of Philadelphia, Pennsylvania, May 4.

The moulds are to be fixed in a mould bench in the usual way, with their smaller ends downwards. The mould bench is placed between two uprights, forming a part of the machine. The moulds must be securely fixed, as the candles are to be drawn without removing them. Below the moulds there are spools or balls of yarn, formed of wick of the size desired; one of these is to be drawn through each mould, and passed out above it; the wicks are all confined to strips, called nippers, which extend from post to post, the whole length of the mould bench. These nippers hold the wicks exactly over the centres of the moulds, and stand at a sufficient height above the tops of the moulds to allow of the pouring of the tallow. The ends of the nippers rest upon racks which rise vertically within the posts, and after the tallow has been poured and has set, a crank is turned, which, operating upon pinions, raises the racks, and draws the candles from the moulds. As this is done, the wick is at the same time drawn into each mould, ready for a new set of candles. A sufficient length of wick is allowed above the moulds to attach other nippers, after which the wicks are cut off above these last nippers, the candles first drawn removed out of the way, the racks lowered, and the whole operation repeated.

Some modifications of this apparatus are described, and a claim is made to the machinery in general.

---

10. For an improvement in the *Making of Boots and Shoes;* Caleb A. Ore, city of Philadelphia, Pennsylvania, May 5.

"What I claim as my own invention, or discovery, is in the uppers, to wit, in making boots with one seam, and shoes without any seam."

For boots, the leather is to be strained into proper form on a crimping board, so as to require a back seam only. For shoes, the leather is to be cut for a whole upper, a hole being made for the instep. This leather is then to be wetted, and rubbed, and crimped upon a last. Slippers, shoes, and Jeffersons, are to be made in this way.

---

11. For an improvement in the *Piano Forte Action;* John F. Nunns, city of New York, May 5.

"The new principle claimed is the action of a lever in front of the hammer butt, instead of behind it, as in the ordinary method of construction: by this method a single key may be withdrawn, without deranging the rest of the action. The hammer is constructed similar to the ordinary plan, with its shaft attached to the butt, which is secured and moveable by means of a hinge or pivot to the rail."

The drawing represents the action as applied to the horizontal grand or plain instruments, exhibiting the whole arrangement in a very perfect manner.

---

12. For an improvement in *Medicine;* Joseph Baker, Jefferson, Ross county, Ohio, May 5.

(See specification.)

13. For a *Butter Churn;* Joseph Crail, Warren, Trumbull county, Ohio, May 5.

A vertical shaft is to have slats or dashers extending from it; the shaft is to run in a pivot on the bottom of the churn, and to be supported at top by a collar. The shaft is to receive a whirling motion by means of a bow and cord, exactly in the manner of the small table churns in very general use in France, and not unknown with us. The patentee says: " What I claim as particularly new, and of my own invention, is the manner of moving the shaft or dasher by a bow and strap."

It unfortunately happens that this particular novelty, as we have above indicated, is very old, although to the patentee it may appear quite otherwise.

---

14. For an improvement in the mode of *Commencing the Generation of Gas,* in the Self Generating Gas Lamp, patented on the 15th of April last, by means of a Spirit Lamp filled with alcohol, or other highly inflammable fluid; Solomon Andrews, M. D., Perth Amboy, New Jersey, May 5.

(See specification.)

---

15. *For applying Animal Power to sundry Mechanical Purposes;* William E. Arnold, Chatham, Middlesex county, Connecticut, May 7.

The power of animals is to be applied by allowing them to walk upon a moveable inclined plane, sustained by rollers, in a way well known. Three or four different modes of constructing the moveable floor are described, but not very clearly; it is calculated by the patentee, however, that his improvements will greatly increase the power derived from the weight of the animal; from what cause it is likely to produce this effect, we have not been able to ascertain.

---

16. For a *Thrashing Machine;* Samuel Fahrney, near Boonsborough, Washington county, Maryland, May 9.

The beaters and bed, or hollow segment, the feeding table, and in fact all the operating parts of this machine, have their counterparts in numerous others; the *invention* of the patentee consists in the mode in which the cast iron beaters are fastened to the heads upon the revolving shaft.

" What I claim as my peculiar invention is the form and arrangement of the bars of the beaters; and the mode in which they are placed and secured on the square block of wood by dovetailing, or locking; and the form of the revolving beater, or square block of beaters."

Like many others, the present patentee appears to have paid the fee, for the privilege of marking " PATENT" upon his machine, which may induce the unwary to suppose that it must be both new and good; the latter it may be, the former admits of doubt.

17. For machinery for *Blowing Wind for the use of Forges, Furnaces,* &c.; Daniel Strobel, jr. city of New York, May 9.
(See specification.)

---

18. For *Concentrating Sirop, or Cane Juice, &c.* by steam; Daniel Strobel, jr. city of New York, May 9.
(See specification.)

---

19. For a Composition for the *making of Beer;* Stephen Hinds, Montrose, Susquehanna county, Pennsylvania, May 11.
(See specification.)

---

20. For a *Mill for Grinding Grain;* John P. Phillips, Doe Run, Chester county, Pennsylvania, and John Holliday, Wilmington, Newcastle county, Delaware, May 12.

In this mill, which is of the small, or portable kind, there are three stones standing horizontally, the middle of the three being the runner, whilst the lower and upper stones are at rest. The patentees say:

"What we claim as our invention is the arrangement of the different parts of the before described mill; the use of a middle stone turning horizontally, faced on both sides, by which different kinds of grain can be ground at the same time, yet keeping the meal separate. Also the manner of hanging the upper stone; the mode of conveying the grain to be ground to the two faces of the middle stone; and the mode of tempering the stones, particularly the upper stone. We do not claim the invention of having three stones, but merely the arrangement of them as above described."

---

21. For Machinery for *lifting Ships out of Water,* for inspection and repair; Thomas Evans, machinist, and John Parsons, ship carpenter, city of New York, May 13.

This apparatus is intended to lift ships vertically out of the water, in the manner of the screw docks; but the power applied is that of the hydrostatic press. Its mode of application, however, differs essentially from that of Thos. Evans, described at p. 160, vol. 6.

Two cylinders, furnished with pistons, are placed horizontally, one at each side of the dock, at the land end. A steam engine is employed to force water into the cylinders, to depress the pistons. To the piston rods, timbers, forming a sliding frame, are attached, which extend along the sides of the dock, and from these timbers chains pass over pullies, and act upon other timbers crossing the dock, and over which the vessel is to be floated, as in the screw docks. There is an ingenious but simple contrivance for letting the vessel down, after her repairs have been completed; this we shall not at present attempt to describe, as it is our design hereafter to give an abstract of the specification, accompanied by engravings.

From some remarks in the specification, it would appear that the operation of this apparatus has been tested; we, however, are not informed to what extent. The principal objection which presents itself to us, from examining the plan upon paper only, is, that it will be difficult, if not impossible, to give to it the strength of the screw dock, so as by its aid to raise vessels of a large class.*

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the process of Dressing Woollen Cloths, and Cloths composed partly of Wool and partly of Cotton. Granted to CALVIN W. COOK, *Lowell, Middlesex county, Massachusetts, April* 23, 1831.

THE description of this process is as follows: Take broad cloths, sattinetts, or any like cloths to be subjected to the process, after they have been fulled and rinsed clean, but before the pile or nap has been raised upon them, and wind them upon wooden rollers, or cylinders, as tight as can be done without tearing the cloth. Confine them with a twine tied around so that the cloth cannot unwind, and so that the whole may remain firm and tight upon the roller, or cylinder; then prepare a kettle, or cauldron, of sufficient dimensions to receive the roller, or cylinder, with the cloth upon it. Fill the kettle, or cauldron, after having put the roller, or cylinder, with the cloth upon it, therein, with water, and apply heat thereto, until the heat rises from one hundred and eighty to two hundred degrees of Fahrenheit's thermometer, for all cloths excepting whites and blues; and for the last mentioned colours the heat may be raised to two hundred and twelve degrees, or to boiling heat. The other colours will not endure so great a degree of heat; the degree of heat can best be decided upon by experience from time to time, owing to the various ways of producing the different colours, in the different parts of the country. The degree of heat above mentioned, it is believed, will in general best answer the purpose without injury to the cloth. The water should be kept at the degrees of heat above mentioned, for the space of six hours; after which the cloth should be taken from the water and suffered to cool upon the roller, or cylinder, which will usually take about twenty-four hours.

Instead of water, steam may be applied at the same temperatures, for the same length of time, and will answer the same purpose; but in this case the cloth must be wound around a revolving roller, or cylinder, which must be kept continually in motion during the process, and the steam must be confined by a wooden box, made very tight, so as to include the rollers, or cylinders, with the cloth upon them, within it. The cloth is to be taken out and cooled in the same way as when heated by water. The operations above mentioned render the cloth very firm in the bottom, divest it of wrinkles and cockles, or drawn places, and render it even and smooth on the surface, so that the teazles, or points, may act uniformly upon the cloth, and the fibre of the wool, or cloth, is thus rendered more pliable, and is more easily turned and laid straight and smooth in the process of teasing, or raising the pile, or nap, thereon. And I, the said Cook, do hereby expressly declare; that all that I claim as new, and of my invention, or discovery, is the subjecting the cloth to the process aforesaid, in the manner aforesaid, and for the purposes aforesaid, after the same has been fulled, and before the pile, or nap, has been raised thereon by the process of teasing.

---

* Some weeks will probably elapse between the date of this patent and that which will be next issued, as, in consequence of the absence of the Attorney General, the signature of that officer cannot be obtained, and without this a patent would not be valid.

CALVIN W. COOK.

Specification of a patent for a Screw or Spiral Lever, for the propelling of Vessels, for a new mode of Navigation. Granted to JOHN JAMES GIRAUD, *M. D., city of Baltimore, Maryland, April 27,* 1831.

INSIDE of a paddle water wheel, or frame, having a round hole in the centre, I place upon two sides, a screw, or spiral lever, three-fourths, more or less, the diameter of the said paddle wheel; this screw, or lever, to be two or more turns of the spiral: this screw lever will be attached to two self acting fulcrum levers in the following manner.

The ends of the levers, where are placed the fulcrum, are fixed, the one opposite to the other by their fulcrum, upon the edge inside of the paddle wheel, the one below, the other above, and distant a few inches from a straight line; the two other ends of the lever are fixed to a square piece of a few inches, with a round hole in the centre, placed in the middle of the paddle wheel; the end of the centre of the screw or spiral lever, is fixed on the side of the end of the lever, which is fixed on the side of the square piece, and the other end, which is made the end of the screw or spiral lever, is fixed upon the other lever, and near the fulcrum.

I place upon the screw or spiral lever, a solid round wheel, twice the diameter of the paddle wheel, with a round hole in the centre, and fixed in the middle upon the square piece above mentioned. This solid wheel has two bars, one opposite the other, which project from its edges, coming level with the edge of the paddle wheel, one below, the other above, without touching it, a little distant from a direct line; place upon the ends of the bars a self acting fulcrum lever, by their fulcrum; the other ends of the lever to pass a little over the hole in the centre of the solid wheel:—a square piece of a few inches, having a square hole in the centre, will be placed between the two ends of the levers, to touch, yet leaving it free. A smaller screw or spiral lever will be placed and fixed to the ends upon the side of the end of the lever, which touches the square piece; and the other end of the screw to be fixed upon the other lever near to the edge of the solid wheel; the same thing to be done upon the other side of the paddle wheel. The shaft of the paddle wheel is square in the middle, and round at each end: the shaft is placed in the holes of the two square pieces, and the power is conveyed there.

I claim the principle of my invention and improvement in every species of levers, and of every form, and figure, and application, as above described. J. J. GIRAUD.

Dr. John James Giraud's Self-acting Fulcrum Screw or Spiral Lever, for propelling Vessels and Rail-road Carts, &c. &c.

Fig. 1.

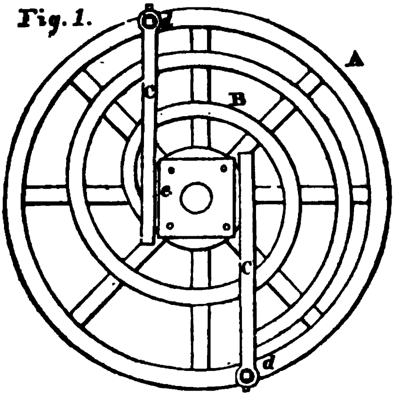


Fig. 2.

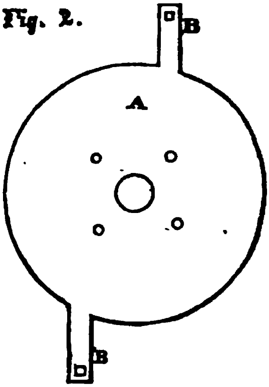


Fig. 3.

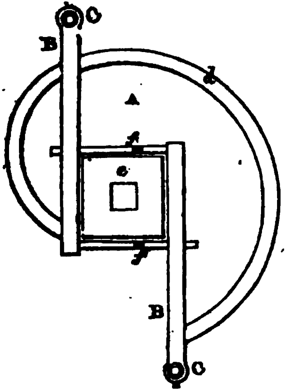


Fig. 1.—A. The inside of one side, or part of the water paddle wheel.

B. Screw, or spiral lever.

c, c. Self-acting fulcrum levers.

d, d. The fulcrum.

e. The square piece with round holes.

Fig. 2.—A. Solid wheel with round hole in the centre.

B, B. Projecting bars with square holes.

Fig. 3.—B, B. Self-acting fulcrum levers.

o, o. The fulcrums.

d. The screw, or spiral lever.

e. The square piece with square hole.

f, f. The moving bars.

☞ Fig. 2 is to be placed upon Fig. 1, and Fig. 3 upon Fig. 2.

Remarks by the Editor.—We have noticed several patents obtained by Dr. Giraud, and have attempted an analysis of them in our monthly list; from the recondite nature of his discoveries we have always risen from our task with a conviction that the attempt has been a failure; and such would have been the case in the present instance. To save ourselves from this mortification, we have determined to publish the specification entire, with the drawings intended to illustrate it.

"A new mode of navigation," if it be an improved one, is an invention of no mean importance, and should any of our scientific readers be more fortunate than we are, in keeping up with the patentee in the elucidation of his mode of "propelling vessels, and railroad carts," &c. &c., we ask of them to supply us with a commentary upon the subject.

Since the foregoing was written, we have seen, in the Baltimore papers, an attempt to explain the operation, and to convince the public of the great value of this machinery. The style of the explanation accords so well with that of the specification, as to fix upon them the character of a common origin. So far as we are concerned, however, the explanation has not served to explain, what the specification failed to specify. They are both transcendental.

Specification of a patent for a Machine for Grinding, Levelling, and Polishing Metallic Plates, to prepare them for the Engraver, and for other purposes. Granted to J. W. STONE, *Washington city, D. C. April* 30, 1831.

To all whom it may concern, be it known that I, J. W. Stone, have invented a new and useful machine for the purpose of grinding, levelling, and polishing plates of copper, steel, iron, brass, or other metals, so as to prepare the same for the use of the engraver, or for other purposes, and to grind, polish, and level metallic or other hard substances, such as marbles, stones, slates, or any substance that require to be ground and polished, and that the following is a full and exact description of the manner in which I effect the same.

When metallic plates are to be ground, levelled, or polished, they are first hammered, or planished, in the usual manner, or made flat in any other way; they are then placed on a flat horizontal bed, which may be made of any suitable material, and sufficiently large to secure the largest piece to which the machine is adapted; the plates are secured to the bed by ledges, stops, or in any other convenient manner. The bed upon which the plate is fixed, is carried backwards and forwards, under the stones, grinders, buffs, or brushes, by which the plate is to be ground, levelled, or polished. The diameter as well as the width of these stones, buffs, polishers, or brushes, may vary according to the power applied to the machine, or the nature of the article operated upon. To give the traversing motion to the bed, a part of the general frame work of the machine forms a rail or carriage way of double the length of the bed. An iron screw, or rack, is placed under the bottom of the bed, and lengthwise of the machine; this iron screw, or rack, is operated upon by means of gearing from the crank or part to which the power used is applied, and for the purpose of giving motion to the other parts of the machinery. When a screw is made use of to move the bed on the carriage, a thread is cut through the centre of a wheel, which wheel is attached to the rail or carriage way on which the bed slides. This wheel is held firmly on its own axis, thereby preventing its moving in a line with the screw, whilst at the same time it turns freely, and when motion is given to it, the screw is forced along, either backwards or forwards, to the distance required. I intend sometimes to attach a toothed wheel to the head of the screw, in order to cause it to revolve; the screw, in this case, will be made to work in a fixed nut, when the same effect will be produced as in the former arrangement. When, instead of the screw, a rack is used, it is fixed to the bed, and a pinion is made to operate on it in the usual way. The shaft to which the power is first applied may be made to revolve in one direction only, and yet carry the bed and plate backwards and forwards, by the addition of gearing, made to engage and disengage, in a way well known to machinists. This gearing, however, may be conveniently dispensed with, especially when the machine is worked by hand, as the crank may be turned either way. The grinding, levelling, or polishing, is effected by revolving stones, grinders, buffs, or brushes; these are fixed on proper spindles with whirls on them to receive a band from the main shaft. The spindle is fixed in a frame in such a way that the grinders or buffs may operate upon the plate. This frame extends back to one end of the machine, where it works upon a pivot, or bolt, which allows it to receive a lateral vibratory motion; such a motion being essential to the proper action of the grinders, buffs, &c. This motion may be effected by placing two eccentric wheels reversed on the shaft to which the power is first applied; one operating on each end of the frame that receives the grinders, buffs, &c. thereby causing the frame to move on the bolt, and consequently give a lateral vibratory motion to the grinders, buffs, stones, polishers, or brushes; or this motion may be effected in various other ways.

The bed that carries the material to be ground, levelled, or polished, and the buffs, polishers, brushes, or stones, as well as the parts which give the vibratory motion, are geared and connected in such a way as to move at one uniform and fixed velocity, otherwise the surface to be ground or polished would be acted upon unequally.

The frame carrying the grinder, &c. I force down by a spring, or weight, or otherwise, according to the force with which I wish them to bear on the material to be ground, making an arrangement to increase or remove the same at pleasure. The lateral vibratory motion of the grinder, polisher, &c. may be increased or decreased in such a manner as may best suit the size or nature of the material to be ground or polished.

The grinders may be made either of wood, iron, steel, copper, lead, stone, or other material, and their action promoted by applying any gritty substance pulverized, either dry or with oil, or water, as the case may require. The grinder, to operate well, should be of a softer material than the article to be ground or polished.

What I claim as my invention is the grinding, levelling, or polishing plates of copper, or other metals, or slabs of marble, stone, slate, glass, or any other material, by placing them upon a traversing bed, and operating upon them by means of revolving stones, grinders, buffs, and brushes, which revolving stones, &c. are fixed in a frame to which a lateral vibratory motion is given; this lateral vibratory motion forming an essential part of my invention.

J. W. STONE.

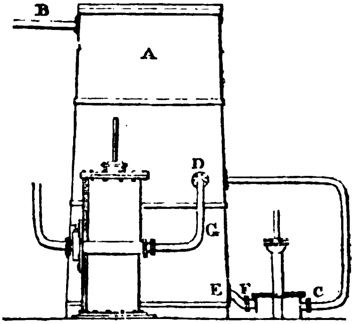
Specification of a patent for an Apparatus to be connected with, and to form part of, a Steam Engine Boiler. Granted to PHILO C. CURTIS, *Utica, Ontario county, New York, May* 3, 1831.

MAKE a tub of about four feet in height, and two feet and four inches in diameter at the top, and two feet eight inches at the bottom. This is a suitable size for a high pressure ten horse power engine. This tub should have two heads, one at each end, and a partition about eighteen inches from the bottom of the tub. In the drawing annexed, the vessel marked A, exhibits the form of the tub. Within the tub, and between the upper end thereof and the said partition, place a strong tube with a calibre of about one and a fourth inches in diameter, and about sixty feet long, coiled similar to a common condensing worm for a distillery. One end of the tube passes through the upper part of the tub, and is firmly connected with the boiler; this part of the tube is marked B. The other end passes through the lower part of the tub above said partition, and is firmly connected with the forcing pump of the engine, as at the letter C on the drawing. The upper part of the tub should be tight, except an inlet, C, for the steam from the piston cylinder; and an outlet for the said steam through a tube firmly connected with the said partition, and from thence extending downwards towards the bottom of said tub; and through which tube the steam is conducted into the lower part of said tub, and below the surface of the water therein; as said lower part should be kept about half full of water. This water may be supplied either from a fountain, or by the operation of the engine, to serve for feeding water for the boiler. A tube of the calibre of the one first above mentioned, should be placed between the tub and the forcing pump, one end of which said tube should be firmly connected with a hole in the side of said tub, and near to the lower end thereof, so as to receive the water from the said lower part of the said tub; and the other end of said tube should be firmly connected with the forcing pump. Letter E on the drawing shows the point of connexion between the tube and the tub; and letter F shows the point of connexion between said tube and the forcing pump. When the engine is in operation, the forcing pump draws water from the lower part of the tub into the tube at E, thence it passes through the pump into a tube at C; thence through that tube as it is continued and coiled, through the upper part of said tub, and so on until it is discharged into the boiler through B. The steam from the piston cylinder is conducted from it through a tube and discharged into the upper part of the tub at the letter D; the steam so discharged fills the said upper part, and heats the water as it passes from the forcing pump through the tube into the boiler, as before described. From this upper part of the tub the steam passes into the lower part of said tub, through the tube of which mention has been before made; and from this part of the tub that part of the steam which remains uncondensed, passes off through another tube; which tube should be connected with the tub below the partition, and above the water in said lower part.

The objects to be effected by the improvement and apparatus above described are, 1st. A reduction in the consumption of fuel for the boiler. This is done by giving to the water which is conveyed into said boiler, a very high temperature, on its passage through the coiled tube in the upper part of the tub. 2nd. This mode of supplying heat for the water in the boiler, is more regular than it could be if furnished by fuel alone; hence less attention to the furnace is required, and the generation and supply of steam from the boiler are more regular than in the ordinary mode. The object of the coiled tube is to form a surface of sufficient size, which being exposed to the steam in the upper part of the tub, will allow the water in passing through said tube, time to acquire, very nearly, the temperature of the steam in the tub, and which, as the water is confined in the tube so that it cannot change into steam, is practicable. The water is thus raised in temperature much above boiling heat, and in that state passes into the boiler. The above described form I think the best calculated to produce the desired effects. The size of the apparatus must be varied in proportion to the capacity of the engine.

The combination of the above apparatus, and the application thereof to effect the objects above specified, are what I claim to have discovered and invented. PHILO C. CURTIS.

Curtis' Steam Apparatus.



Specification of a patent for an improvement in Medicine. Granted to JOSEPH BAKER, *Jefferson, Ross county, Ohio, May* 5, 1831.

A MODE of *prepareing*, mixing, compounding, *administering* and *useing* the medicine herein described in the *maner*, and in the diseases hereinafter mentioned: that is the mode of *prepareing* and compounding medicine for an emetic and *al so* to *cous* a free *per spiration* to be administered in diseases *coused* by cold and *ob structed* perspiration, such as *fevurs rumatism, dysentery* dropsy *consumtion pleuricys* Boldhives and all stagnated complaints with some others

N. B. All *Root* and Barks and Herbs must be first dried pounded in a *morter* or ground in a mill before *thay* are made *in to* medicine

Part the first.—Take *Sinaca* snake root one ounce Take Liver wort tops three quarters of an ounce Take *plantin* roots and tops one quarter of an ounce mix these well *to gether* this *formes* the first part of the *compasition*

Part the Second.—Take the Bark of the root of *sasafras* a half ounce—Take the *in side* Bark of wild *Chery* a half ounce.—Take the *in side* Bark of Elder a half ounce—Take *Sulfer* or *Brim stone pulferised* a half ounce mix these well *togethur*—this *formes the se cond* part of the *compasition*

3d part.—Take *Lobela* or what may be known by the name of indian *tobaco* the tops gathered in september two ounces

This *formes* the third part of the *compasition* which is to be administered *all togethur* or in parts as the nature of the case may require—It should Be remembered that *Equel* portions of these three parts *formes* the whole *compsition* of medicine,—It should be remembered that a dose of *Ither* of these powders for an ordinary *constatution* is on average tea spoon full and *a lowance* should be made for the *diferent constituons* of people

When the violence the *diseas requiers* a *speady remady* and Nature calls for an emetic and there is an *ob structed* perspiration it is *nesasary* in this case to give a dose of powders of the whole *compasition* and wash them down with a half a *point* of cold weak lie made of the bark of shell bark *hickary*, and if this dose do not operate as an emetic in 15 Minutes give a second dose with a less' *quantaty* of lie or *jist a nough* to wash it down and if it doth not operate in the same time you may try the third and *fouarth* on the same rule which will *scarly* fail this process commonly produces a free perspiration then continue the process by *giveing* a dose of powders of the first part of the *compasition* and in thirty minutes sweat until you get a free sweat over the body the way to sweat is to cover the person all over and make *youse* of two over lids one at a time have their feet in warm water and *sit* your over lid under the cover and form a mixture of one third *whisky* and two thirds water of *a bout* three gills and steam it on the over lid as *thay* can bear it and repeatedly *sup* warm tea and when done put them to bed cover *thir* breath a short time with a hot stone *squinched* and *wraped* up in a wet cloth at *thir* feet *thir* teas should be spice bush or red *peper* during sickness make a drink of water by *squinching* a hot *cole* in it *tell* the chill is *of*

Take two doses of the *fiers* part of the *compasition* in the course of 24 hours and one of the second part *divideing* the time of *takeing* them—and sweat once a day for three days and if the person have fever and ague *sweet* once a day *untill* it *leaves* them and keep up a moist sweat as steady as *posable* during the whole time and keep them warm in the chill and fever—*there* diet should be light such as chicken or squirrel broths with a little of the meat and as little bread as *posable thay* can make *youse* of rice or *homany* But keep the *stomack* as empty as *conveenyant* and *espesually* for three days and *aftur* that *thay* can *in creas thir* diet *gradualy untiel* well

If the *diseas* is less violent you may leave out the first part of this process and begin by *giveing* a dose of the first part of the *compasition* and then sweat and so follow the rule as is laid down *a bove* and if it is found that the first part of this process is *ne sa sary* it can be *aplyed* at any other time

In *pluracys* and bold hives and many other complaints it is only *nesasary* to *persue* the rule *untill* the *patiant* recovers which is not likely to be long

Let it be well remembered that nature is the Grand *Phesition* and *wee* are only to assist her in *removeing* the *ob structtions* that *is* found in her way as far as is in our power and that *whe* should pay *petickler atention* to her *clames* and try to supply her wants if *posable*

In cases of less violence these powders may be taken without a preparatory sweat either in whole or in separate parts as the cases may require JOSEPH BAKER.

Remarks by the Editor.—It has been with some difficulty that we have done justice to the new orthography employed in making known the foregoing new and improved mode of curing diseases; as, however, it would have been the height of injustice to its author to have added, or abstracted, a jot or tittle from his elegant memoir, we have cheerfully undertaken the labour of following him through all his labyrinths. We are truly glad that we are not called upon to write a commentary upon the system, and still more so that we are not compelled to have its efficacy tested by becoming the *patiant* of this great *Phesition.*

Abstract of the specification of a patent for a method of Generating Gas, and of supplying and continuing Gas Light, out of oil, or other suitable substance, by means of the gas light itself, in lamps, or machines, either fixed or moveable. Granted to SOLOMON ANDREWS, *M. D. city of Perth Amboy, Middlesex county, New Jersey, April* 15, 1831.

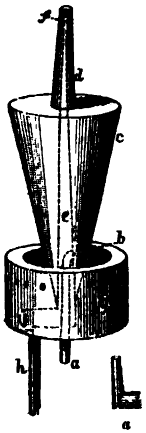
THIS invention consists in having the gas lamp so constructed that the heat of the inflamed gas, or gas light itself, operating upon the oil or other substance used for the purpose, shall continue to form gas therefrom to supply or feed the gas light. In the accompanying drawing the letters *a, a,* represent a part of the supply tube through which the oil or other material enters, of which the gas is made; *b,* the upper end of the supply tube emptying into the bulb; *c,* the bulb, represented in the form of an inverted cone, which may be filled with fine wire, to communicate heat the more readily throughout the contained fluid, the gas being generated in this bulb: *d,* a turret erected to cover the gas tube, *e,* which is best elongated so as to extend above the bulb, to prevent any particles of oil or other substance from entering the gas tube. *f,* the entrance into the gas tube, which descends down through the bulb into the gas recipient, *g*, through the holes or orifices of which the gas which is to be inflamed issues. The dots around the recipient represent these orifices, and *h* a waste tube to carry off any surplus oil.

The oil to be decomposed enters at the orifice of the supply tube, passes up that tube into the bulb, where it is converted into gas by the heat of the flame surrounding it. The gas rises to the top of the bulb, and turret, and passes down the gas tube into the recipient, whence it issues through the openings at which it is to be lighted. The surplus tube serves to conduct off any particles of fluid which may come down with the gas, and thus prevents obstruction.

In order to light the lamp, oil must be admitted into the bulb; this part may then be heated by a common candle or lamp, but it will be much facilitated by using a small blow pipe. When a small portion of gas issues through the openings in the recipient, it will inflame, and the generation and combustion be continued.

To preserve the oil at a proper height in the bulb, allowing a sufficient supply without endangering its raising too high, and flowing into the gas tube, several devices may be adopted, as by the common fountain lamp, or by using a stop cock, and adjusting it so that no more than the proper quantity shall enter.

S. Andrews' Gas Generator.



Silver, as being the best conductor of heat, and resisting oxidation, is esteemed the most suitable metal for making the apparatus.

"My new invention consists in generating and forming out of the oil, or other substance used for the purpose, the gas which continues and supplies the flame of the gas light, by the application of the heat of the inflamed gas itself to the oil or other substance used, so as to cause a continued gas light, and without the intervention or use of wick, to burn in contact with the flame, and in so constructing and forming the gas lamp, or machine, as to produce that effect."

SOLOMON ANDREWS.

Abstract of the Specification of a patent for a mode of commencing the generation of Gas in the Lamp described in the preceding specification, by means of a spirit lamp, filled with alcohol or other highly inflammable fluid. Granted to SOLOMON ANDREWS, *M. D. city of Perth Amboy, Middlesex county, New Jersey, May* 5, 1831.

IN lighting the lamp described in the foregoing specification it is stated that after oil has been admitted to the bulb, that part may be heated by a common candle, or rather by the aid of a small blow pipe, in order to commence the decomposition of the oil, and its consequent conversion into gas. The present invention is intended to obviate the difficulties attendant upon these modes of commencing the combustion.

To effect this, the supply tube *a*, represented in the cut in the last article, is to be surrounded by a small cup, about the diameter of the recipient *g*. This cup is to be supplied with a small portion of alcohol, or other inflammable fluid which will burn without a wick; when this fluid is lighted, the flame produced by it will heat the bulb *c*, and convert a portion of the oil contained in it into gas. To supply this cup it is proposed to have a small reservoir, somewhat similar to that for oil; a tube from this reservoir, is to lead into the cup, a small stop cock allowing a portion to flow in when wanted.

"My newly invented improvement, which is the subject of this patent, consists in generating gas in the first instance of my new invented gas lamp or machine, and so as to put the new invented gas lamp, or machine, into operation, by means of the flame of the said alcohol, or other fluid, rising up and surrounding the bulb of the said gas lamp, or machine. And in so constructing and applying the spirit lamp, or machine, as to produce that effect."

Remarks by the Editor.—At page 32, of vol. I, (for Jan. 1828,) will be found a cut and description of a "self generating gas lamp," taken from the Edinburgh Philosophical Journal. Its principle of action resembles the foregoing, although the parts are *differently* arranged. In the Edinburgh lamp it is proposed to cause the generation of the gas to commence by the application of a small iron heater prepared for the purpose. Whatever ingenuity may be displayed, however satisfactory the operation of an instrument may prove, and how great soever may be the interest excited on its first introduction, if it is intended for ordinary use in domestic economy, there must be no greater trouble in putting it into operation than has attended the apparatus for which it is to be a substitute, or its chance of continued favour will be very small. The original "self-generating gas lamp," we apprehend, failed from this cause, and we are fearful that the one before us will be unable to surmount the opposition of chamber maids, cooks, and scullions.

Besides this difficulty, will there not be a rapid accumulation of carbonaceous matter in the reservoir, from the mucilage always contained in oil? There is no provision made for cleaning it out, nor does it appear easy to remove this objection.

We have seen the lamp in operation; the flame was clear, but somewhat flickering, a defect which probably was accidental. The oil did not appear to be perfectly converted into gas until it issued from the recipient into the flame; for, if extinguished at some of the orifices, it escaped from these in the form of a dense vapour, which the flame would have decomposed and converted into gas.

Specification of a patent for an improvement in Machinery for Blowing Wind, for the use of Forges and Furnaces. Granted to Daniel Strobel, Jr., *Civil Engineer, then of the city of Washington, but now of the city of New York, May* 9, 1831.

To all whom it may concern, be it known, that I, Daniel Strobel, Jr., have invented an improvement in the machinery for blowing wind, for the use of forges and furnaces, and that the following is a full and exact description thereof.

The principle which I have adopted has been already applied to the raising of water in pumps, in which the part operating as a piston has been made to work without friction against the sides of the chamber; but the form of the chamber which I have adopted, the general arrangement of the apparatus, and the application of it to the purpose of blowing, constitute my invention.

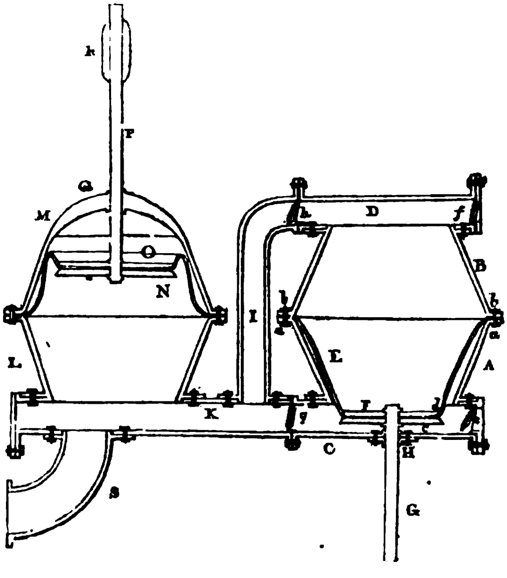
The accompanying drawing shows a longitudinal section of a double acting blowing machine on the before mentioned principle, (in this case supposed to be worked by the lever beam of a steam engine,) in which A and B represent two conical vessels joined together by flanches and screw bolts at their larger ends, and having their small ends joined to two square valve boxes, C and D. E represents a leather diaphragm, capable of assuming the conical form of one of the vessels; the edge of this leather is securely fastened to the conical vessel, (formed by the two vessels A and B,) by being bolted between the two flanches *a a*, *b b*, of the vessels A and B. The middle of the diaphragm is firmly secured to a metal or wooden disk, F, by being bolted or rivetted between the two plates, *c* and *d*, of which the disk, F, is composed. G, is a polished cylindrical metal rod securely fastened by one end to the centre of the disk, F, the other end communicating with the moving power. H, is a stuffing box containing two cupped leathers through which the rod, G, works:—the cupped leathers, stuffing box, and its gland, are too well known to need any description. *e*, *f*, *g*, *h*, are four hanging valves, *e* and *f* communicating with the atmosphere, and *g* and *h* with two passages, I and K, leading from the valve boxes, C and D, to the air vessel or regulator. The regulator is constructed on the same principle as the blower, being composed of two conical vessels, L and M, connected together by their larger ends in the same manner as the vessels A and B. The smaller end of the vessel L, is joined to the horizontal passage K, whilst the smaller end of M is open to the atmosphere. The vessels L and M contain also a leather diaphragm, N, similar to E, which diaphragm, N, is connected to the vessels L and M in the same way as E is connected to A and B. To the middle of the diaphragm N, is affixed a disk, O, in the centre of which is fastened a metal or other rod, P, which passes through a guide, Q, adapted to the vessel M. The upper end of the rod, P, carries a weight, R, which must be proportioned to the density of the blast desired. To the horizontal passage, K, is fixed the pipe, S, conveying the blast where it is required. The operation of this machine is as follows—motion being communicated to the rod G, (which is supposed to be just ascending,) a partial vacuum will be formed in that part of the blower situated below the diaphragm E, at the same time the valve *e* will open, and the atmospheric air will rush through it to restore the equilibrium, whilst the air, situated above the diaphragm E, will become compressed until its elasticity becomes sufficient to force open the valve, *h*, leading to the regulator. As soon as the rod, G, begins to descend, the valves *e* and *h* will close, and *f* and *g* will open; *f* admitting air above the diaphragm, and *g* permitting that below to escape into the regulator. The regulator keeps up the continuity of the blast, which would otherwise be interrupted at the change of stroke, by an enlargement or a diminution of its capacity, in a manner which will be readily understood from the annexed drawing.

In constructing this apparatus I do not intend to confine myself to the particular arrangement which I have exhibited, or to the precise form given to the wind chambers. The latter may be barrel shaped, or otherwise enlarged towards their middle, for the purpose of allowing free play to the leather diaphragm, this being the object of the enlargement. The machine also may be made single, instead of double, with the regulator placed immediately over the blower.

What I claim as my invention, and for which I ask a patent, is the application of a vessel, such as I have described, with its diaphragm and disk, to create a blast both in the ascending and descending strokes, upon the principle herein set forth. And the employment of a regulator, acting in the manner, and for the purposes which I have fully explained in the foregoing specification.

Daniel Strobel, Jr.

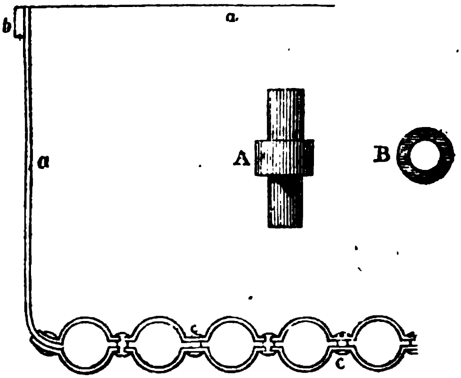
Strobel's Blowing Machine.



Specification of a patent for an improved mode of applying the heat from steam to the purpose of concentrating Sirop, or Cane Juice, &c. Granted to DANIEL STROBEL, *jr. then of the city of Washington, but now of the city of New York, May* 9, 1831.

To all whom it may concern, be it known, that I, Daniel Strobel, jr. have invented an improved mode of applying the heat from steam to the purpose of concentrating sirop, or cane juice, and other articles in which this process is required; which invention is also applicable in the process of distillation, and that the following is a full and exact description of the same; reference being had to the drawings which accompany this specification.

Strobel's Evaporating Pan.



The still, or evaporating pan, may be made in any of the usual forms, and of any suitable metal, my improvement consisting in the manner in which the bottom is constructed. The accompanying cut represents a part of an evaporating pan, cut through by a vertical plane passing through it, perpendicularly to its length. *a*, shows the sides of the pan. *b*, an iron band passing round it, and secured by rivetting, or otherwise. *c*, *c*, shows the manner of making the bottom, which is double, being formed of two or more plates of metal, between which the steam is to pass. Each plate is indented, fluted, or grooved, in the manner represented in the drawing; each groove forming one-half of a cylindrical, or other formed, cavity. The two plates are then to be tied together by means of rivets; not, however, in such a way as to cut off the communication between them, but allowing a free passage of steam from one to the other. For this purpose I intend generally to make the rivets with a double shank, as shown enlarged at A, the projection between the shanks, serving to separate the plates. The same end may be attained by washers, or by strips of metal crossing the flutes. B shows a horizontal projection of the double shank rivet.

The double plates, forming the cavities herein described, instead of forming the bottom of the evaporating pan, may be placed within any of the pans now in use, parallel to, and elevated a little above the bottoms of them, thus exposing the sirop, or liquid, to the action of both sides of the heated metals.

I do not particularize any mode or manner of introducing the steam, as this is familiar to every machinist, or engineer; nor is it necessary to describe the modifications which will be required when the double plates are elevated above the true bottom of the pan, as these also are sufficiently obvious without such description.

What I claim as my invention in the apparatus hereinbefore described, is the indenting, fluting, or grooving of plates of metal, and tying or uniting the same together for the purpose, and upon the principle which I have set forth. DANIEL STROBEL, Jr.

Specification of a patent for a Composition for the making of Beer. Granted to STEPHEN HINDS, *Montrose, Susquehanna county, Pennsylvania, May* 11, 1831.

To all to whom these presents shall come, be it known, that I, Stephen Hinds, of Montrose, in the county of Susquehanna, and state of Pennsylvania, have invented a new and useful composition for the making of beer, and that the following is a full and exact description of the composition and process of compounding the same as invented by me, to wit: one pint of molasses, one pint of new milk, and one pint of common hop yest, are put into a six gallon keg, which is then filled with air, by means of a pump, or in any other mode most convenient, until no more can be compressed into the cask; it is then corked up, and let remain in that state for twenty-four hours. At the expiration of that time, two gallons of water are mixed with one quart of molasses, one ounce of ginger, half an ounce of allspice, and half an ounce of the essence of spruce, heated boiling hot, and put into the cask, with three and a half gallons of cold water, again corked up, and permitted to remain twenty-four hours longer. The beer will then be fit for use. When the beer is drawn out, except two quarts of the sediment, which should be left in the cask, the last described composition can be again added to it, and so on during the season.

What I claim as new and as my own invention in the above described manufacture and composition, and for the use of which I ask an exclusive privilege, is the composition first above described, the proportions of the second described composition, and the whole process of making.

The whole of the beer should be drawn without a vent. The carbonic gas generated in the beer, renders one unnecessary.

STEPHEN HINDS.

Specification of a patent for an improved Machine for Cutting Grass and Grain. Granted to William Manning, *Plainfield, Essex county, May* 3, 1831.

I provide an axle tree with two wheels, of the common construction. To this axle tree I attach shafts, by which a horse is to draw the machine. From the axle tree extend two arms in the direction of the shafts; these arms are morticed into, or otherwise attached to the axle tree; they are of greater length than the shafts, extending beyond them a sufficient distance for the cutting apparatus to be entirely clear of the horse. The two arms are united together by a cross bar at their extreme ends; which cross bar, when the machine is in action, rests, and slides forward on the ground; teeth of six or eight inches in length, more or less, are set like rake teeth, standing forward on the cross bars. These are made slender, and are for the purpose of holding the grass or grain to be cut.

The cutters stand immediately above the teeth; and receive a traversing motion in a way to be presently described.

A flat bar of iron lies along upon the cross bar, and the cutters are to be attached to this upper bar. The cutters are spear shaped, and are sharpened on each of their edges. They may vary in their length and width, but ordinarily they may be about six inches long, and three or four wide at their bases. The grass or grain which is held up by the teeth, passes between these knives, or cutters. To give a traversing motion to them, a lever may extend from the inner end of the hub of one or both of the wheels, to the cutter bar; this lever may work upon a pin at or near its centre; a zigzag groove in the hub, or in a wheel attached to it, will give it a vibratory motion, and its connexion with the cutter bar at the opposite end, will cause that to traverse.

I intend sometimes to make the cutters revolve instead of traversing. They are then to be fixed upon the periphery of a wheel; the teeth being placed on a fixed semicircle. The cutters will then have one sharp edge only. The wheel may be made to revolve by bands, or gearing, from one of the main wheels, in various ways.

When the machine is small, it may be moved by the power of a man. The shafts may be fixed forward of the cutters, and the general arrangement be varied, without altering the main principle of my machine.

What I claim as my invention, and for which I ask letters patent, is the combined action of the teeth and cutters, whether the cutters are moved in a traversing or a revolving direction.

William Manning.

ENGLISH PATENTS.

To Thomas Botfield, *coal and iron master, for his invention of certain improvements in making iron, or in the method, or methods, of smelting and making of iron. Sealed 2nd January*, 1828.

Two leading features are proposed by the patentee as novel in connexion with the smelting of ore, which are the adaptation of a high chimney to promote a draft of air in a blast or cupola furnace, and the employment of salt or other substance containing soda in the process of smelting the ore.

The particular form of construction of the apparatus does not appear to be important, it is simply proposed to erect a high chimney contiguous to the cupola, with channels, or flues, leading from the lower part of the furnace, opposite to the tuyere hole, where the blast of air enters, and also from the upper part of the cupola into the high chimney, by means of which a very considerable draft will be produced through the tuyere hole, and the ore become more effectually operated upon by the consequent increased heat of the furnace, than in the ordinary construction of blast furnaces.

As it is considered that the employment of heated air would improve the blast, and be beneficial to the metal produced, a small furnace or heating stove is placed contiguous to the tuyere hole, and a current of air passed through it, which air, after it has become heated, is brought into the blast at the tuyere hole, and is carried through the furnace by the draft of the chimney.

The employment of salt, or other material, containing soda, is confined by the patentee to the operation of smelting the ore. The same was used by Mr. Duckock, for manufacturing iron in the puddling furnace. [*Lond. Jour. of Arts and Sciences.*

To James Smethurst, *lamp manufacturer, for an improvement, or improvements, in lamps, communicated to him by a foreigner residing out of the British dominions. Sealed 6th November*, 1827.

This invention is a lamp for the table, on the hydraulic, or fountain principle, in which the oil is made to rise up a column to the burner, by the pressure of a descending column of some heavier fluid. The oil is placed in a receptacle near the bottom of the pedestal, from whence it is intended to rise through a perpendicular pipe to the burner. A reservoir of water, or other fluid, is placed in the upper part of the pedestal, which descends by a pipe to the under part of the oil vessel, and there opening a valve upward, enters below the column of oil in the receptacle, and gradually raises it in the column up to the wick.

The principle on which this lamp is intended to act is by the difference of specific gravity between the oil and the water, or other fluid employed in the descending column, which the patentee states, should be in the proportion of two to three. The form of the pedestal and shaft may be cylindrical, or of various other shapes, containing the reservoirs and pipes within.

When the charge of oil has been consumed, in order to recharge it, a high funnel is affixed to the top of the column, near the burner, into which the oil is to be poured, when by the superior height and consequent preponderating weight of the oil in the funnel above the burner, the water, or other fluid, will be forced back again into its elevated chamber, and will have no power to expel the oil from its receptacle until the high column in the funnel is removed.

The lamp is furnished with a receiving vessel for the occasional small overflow of oil, and also a vent aperture for the purpose of allowing the water to flow; and in its general appearance resembles other table lamps constructed upon the fountain principle. [*Ib.*

To CHARLES DEROSNE, *Gentleman, in consequence of a communication made to him by a certain foreigner residing abroad, and inventions by himself, for an invention of certain improvements in extracting Sugar or Sirop from Cane Juice and other substances containing sugar, and in refining sugar and sirops. Sealed* 29*th September,* 1830.

THIS invention consists in a mode of discolouring sirops of every description, by means of charcoal produced by the distillation of bituminous schistus alone; or mixed with animal charcoal, and even of animal charcoal alone.

Whatever sort of charcoal it may be, it must be disposed on very thick beds, on a filter of any suitable form. The filter of itself has nothing peculiar, and does not form the object of the patent, because it is already known and used for other purposes, but till now it has not been employed for discolouring sirops.

To obtain this discolouration, the charcoal is put in a case, in which is placed, at the distance of about an inch from the bottom, a metallic diaphragm pierced with a great number of holes; upon this diaphragm is placed a coarse linen, or woollen cloth, which exactly covers it; and upon this cloth a bed of charcoal of bituminous schistus alone, or mixed with animal charcoal, or animal charcoal alone, as above said. Whatever it may be, this charcoal ought to be in a finely divided state, in order that it may be well penetrated with the sirop which is intended to be filtered. Charcoal in powder would not be penetrated by the sirop.

It has been found that charcoal reduced to the size of fine gunpowder, is very fit for this operation; if the grain is too large, the filtration would operate too rapidly. The charcoal should be lightly pressed, and then new beds of the same charcoal placed upon it, which should likewise be pressed till it has come up to the height of fifteen or sixteen inches. It may be made higher if found necessary, or it may be less, but the discolouring effect will be always in proportion to the thickness of the bed of charcoal.

When the charcoal is disposed to the proper thickness, it is to be covered with another metallic diaphragm, pierced likewise with holes, upon which is spread another clear linen cloth; upon this cloth the sirop is to be poured which is intended to be discoloured. The sirop ought then to form a bed of several inches thick, from four to eight, although there is no precise rule.

For operating well in the filtration of sirops, the sirop ought to be clear before pouring it upon the filter, and ought to have undergone a first filtration by the ordinary means; the object to be obtained by this filtration through the thick beds of charcoal is only the discolouration of the sirops.

The sirop to be filtered ought not to exceed the consistence, which is produced by two-thirds of sugar, and one-third of water; but it may be filtered at any less degree of consistency according to the result required. When the sirop is hot the filtration operates a great deal more rapidly.

In operating on a great scale, a reservoir filled with sirop can furnish several filters at one time. The first portion of sirop which passes through the filter is always the least coloured, and by the time the colouring part combines itself with the charcoal, the effect of the last portion becomes less sensible. That portion of sirops, which retains a part of its colour after filtration, can be passed again through another bed of charcoal in another filter, and by this means it may be obtained in a great degree of purification.

Whatever the kind of charcoal used, it is desirable to mix the charcoal with about one-sixth part of its weight of water before putting it in the filter. The place of that water is occupied by the sirop which penetrates the beds of charcoal; and when the water comes at first, it has a disagreeable and salted taste, when the animal charcoal is used, the water after that comes mixed with a portion of sirop, and soon after it is displaced by the pure sirop.

When the charcoal has been deprived of its discolouring effect, water is to be poured upon the filter for dissolving or displacing the sirop which may be mixed with the charcoal, the sirop then comes pure first, and after that mixed with more or less water, using as little water as possible. It is convenient to suspend occasionally the effusion of water on the upper part of the filter by shutting its cock. The sirop being heavier than the water, gains the bottom of the filter and runs first.

The sirops made with raw sugar by this process can be made as clear as water, the molasses are deprived of their bad taste, and are converted into a good kind of sirops of a clear and yellow colour.

The sirops from which it is desired to separate the colouring matter can be obtained directly from the juice of cane, or of beet root, or from the saccharine matter produced by the action of sulphuric acid upon the farinaceous matters, before these juices or liquids have been baked for extracting the sugar. The sirop may likewise be produced from the solution of all kinds of sugar, and of the products of inferior quality, which are obtained in sugar refining under the name of "bastards" and other sugars. The purpose of producing of sirops may be to sell them in such a state for the ordinary consumption, or to bake them for making sugar whiter than is obtained by the common process, or these whitened sirops may be used for discolouring the refined sugar, in making them filter through the loaves, instead of the earth and water commonly used.

The object of the invention being to obtain discoloured sirops by the means above described, this discolouration of sirops is always proportionate to their primitive colouration, and to the quantity of charcoal which is used.

In the carbonization of bituminous schistus there is nothing peculiar; it is produced in close vessels, as is done for producing animal charcoal, only it is convenient before the carbonization, to separate from the bituminous schistus the sulphurets of iron which are mixed with it. Instead of using the schistus, or animal charcoal of the size of gunpowder, it can be reduced to a powder still more fine, mixed with sand. In this state a given quantity of charcoal discharges the colour better than powdered less fine, but the filtration is slower, and more difficult to be regulated. The patentee says, "having tried this method, I have given the preference to the other mode, but both of them are the object of the patent." [*Ib.*

To JOHN HENRY GUNTHER, *piano forte manufacturer, for his invention of certain improvements on piano fortes. Sealed* 10*th July,* 1828.

THIS invention is the adaptation of an additional sound board to piano fortes, which is to be made much stronger than the ordinary sound board, and to be placed above it. This board is proposed to be made of hard wood, about a quarter of an inch in thickness, but rather thinner towards the base; it is to be fastened to the framing of the instrument, and made particularly firm and capable of sustaining the tension of the strings, as the bridge and rails for the hitch pins are to be affixed to it. This and the ordinary sound board are to be connected by blocks, so that they shall both vibrate together; and it is stated that the adaptation of this improvement to piano fortes, whether of the horizontal or upright kind, very greatly improves the strength and tone of the instrument. [*Ib.*

To PETER RIGBY WASON, *Esq. barrister at law, for his having invented a certain improvement in the article commonly called stick sealing wax. Sealed* 25*th September,* 1828.

THE patentee has experienced what every one who seals a letter with wax must also have experienced, the great inconvenience of not being able to keep the stick of sealing wax in a blaze, or to make the wax flow on the paper, without the trouble of several times relighting the stick; no one, however, that we have ever heard of before the patentee, has suggested the simple idea of placing a wick through the centre of the stick, which ingenious thought forms the subject of this patent.

The material, or composition, of which the sealing wax is made, though not claimed as new, is described as consisting of shell lac one part, vermilion one part, and Venice turpentine one part, (by weight we presume,) which are to be reduced into a mass over a slow fire, and when thus properly mixed, the portion which is to constitute a stick, is to be rolled out to its proper dimensions upon a heated copper plate: when that is done, a groove is to be formed along the middle of the stick, and a straw inserted, which is to constitute the wick. The stick of wax is then to be rolled again upon the heated copper plate, for the purpose of enclosing the wick, and being afterwards marked with such patterns or devices as may be thought desirable; on becoming cold the stick is ready for sale, or for use.

On lighting the end of this improved stick of sealing wax, the straw will sustain a small flame, which will, as a taper, keep the wax in a blaze, and flowing as long as may be required. [*Ib.*

To Samuel Brooking, *Esq.*, *a Rear Admiral in the Royal Navy*, *for his invention of a new method or mode of making sails of ships, and other vessels. Sealed* 4*th September*, 1828.

It has been found that in consequence of the strain which is given to sails in angular directions, by the pressure of the wind, they invariably stretch from corner to corner, and bag in the middle, which causes them to be much sooner destroyed than they would otherwise be, if the strain was supported by a diagonal seam. It is therefore the intention of the patentee, instead of making sails by joining the breadths of canvass in perpendicular directions, to make the seams diagonally, that is, from corner to corner of the square sails, and in such manner crosswise of all other formed sails, as to give that strength and resistance in the direction of its greatest tension, which will prevent the stretching of the fibres of the material, and render the sails much more durable.

There does not appear by the specification, to be any novelty proposed in the mode of making the canvass, or in the forms of the sails, but merely in the way in which the canvass is to be cut, and the direction in which it is to be sown together, to make the sails, which constitutes the subject of this patent. [*Ib.*

Patent granted to Joseph Budworth Sharp, *Esq., and* William Fawcett, *of Liverpool, Civil Engineer, for an improved mode of introducing Air into Fluids for the purpose of Evaporation. Dated October* 20, 1830.

In the drawings of this specification a tube is represented suspended vertically over a circular pan, from the lower end of which tube two smaller ones radiate horizontally, and nearly touch the sides and bottom of the pan. The vertical tube, which is perforated at the upper part, works easily in brasses placed in a suitable framing, and by means of proper gear, is made to revolve in a horizontal direction. The result of this, it is assumed, will be, that by the movement of the radiating pipes in the liquid, an inclination to a vacuum is created; and the air, from this circumstance, rushing through the aperture at the top, passes through the liquid and causes a great evaporation, whilst the constant motion of the pipes prevents the liquid from collecting on the sides of the pan and carbonizing.

The nature and properties of the Sugar-Cane, with practical directions for the improvement of its culture, and the manufacture of its products.—By George Richardson Porter.*

[Continued from vol. vii. p. 342.]

When all is properly prepared for each operation, and the reservoirs for the expressed juice are filled with a known and fixed quantity, it is made to flow into the first clarifier. The proportion of quick lime, for separating the feculencies, should be immediately ascertained. For this purpose, an hydraulic balance should be used; this was invented by an Englishman, and introduced, two or three years ago, into St. Domingo, (1789.) This balance, which is very ingenious, serves to show the quantity of feculencies which exist in the expressed juice, and the quantity of lime necessary to separate them. Although it may not rigorously indicate what is the necessary quantity for the complete clarifying, it is, however, very useful in determining the quantity of lime which ought to be employed in the first instance. Its use is extremely safe, as the proportion of lime which it indicates is never in excess. The lime thus weighed is put into the juice with which the first clarifier is filled. That its action may take place at the same time over all the juice, great care is taken to spread it, by agitation, for a minute or two, with a ladle; then it is poured entirely into the concentrator; after having filled all the boilers with a charge thus tempered, heat is applied. The coppers, of course, receive a degree of heat relatively to their proximity to the fire place. The juice of the concentrator, therefore, is the first whose feculencies separate; the action of the heat proceeds successively through the boilers. The first feculencies are removed by the scummer, from each of the boilers, as fast as they rise to the surface of the fluids; they are poured into wooden buckets, and carried to their place of destination. Those of the first clarifier are poured into the basin, which is between it and the wall, from whence they flow out into the vessel placed there to receive them. The impurities of the second sort are poured into the little basins, on the surface of the laboratory. The juice, which is unavoidably removed with them in scumming, carries them through the channels into the first clarifier, where they are again removed with the scummings of this copper. The scum is taken off as fast as it is produced, and to each charge, if it be thought necessary, lime in substance, or lime water, or some other alkali is added. When the sirop of the concentrator indicates twenty-two or twenty-four degrees of the saccharometer, the fire is damped, and the sirop is laded into the basin which communicates with the vessel. Immediately after having emptied the concentrator, it is filled again with the *entire* charge of the evaporator, the heat is continued, and the contents of each copper pass successively from one to the other till they reach the evaporator, leaving the first clarifier empty, and this is immediately supplied with a fresh accession of juice. In the mean time, as fast as the cane liquor reaches the vessel, placed at the foot of the reservoir, it is poured upon the filters, and falls into the reservoir, freed from the solid matter which it contained. The scumming and evaporation are continued—the contents of one copper are passed successively into another—the sirop in the concentrator is passed into the vessel, and thence into the reservoir for subsidence, till this is filled. The different steps of the work should be so disposed, that the first reservoir for subsidence should be filled about six or eight o'clock in the evening. Then the sirop, always evaporated to the same degree, is conveyed in the same manner to the second reservoir, by the canal which communicates with it, and this work is continued through the night. Towards five or six o'clock in the morning the fire is damped, and the concentrator is emptied; after well washing it, if required, the valve of the first reservoir is raised, the filtered cane liquor runs perfectly pure into the concentrator, having deposited, during eight or ten hours of perfect rest, the feculent and earthy particles which, owing to their extreme fineness, had passed through the filters.*

---

* This valuable work has been recently republished by Messrs. Carey & Lea.

When the concentrator is charged by this means, with a quantity of sirop suitable for making a boiling, the valve is shut, and it is ascertained whether the clarifying is well and perfectly done. For this purpose some sirop is taken in a silver spoon, and inspected in different points of view, in order to ascertain that it contains nothing perceptible to the eye. Some drops of lime water are poured into this sirop, which should appear very clear and transparent, and it is then examined anew.

---

* Monsieur Bonmatin gave an account, in the year 1814, of his method of extracting sugar from beet root, which appeared to the French government to have so much importance, that they caused it to be printed and distributed in those departments where that branch of manufacture was followed. In this account Monsieur Bonmatin states, as one part of his process, that after the evaporation of the juice to the state of sirop, as indicated by 32° of Beaume's saccharometer, and before its concentration, to obtain crystalline sugar, he allows the sirop to rest during four days, in order that all the foreign matters which it contains may subside.

If after one or two minutes no solid particles are perceived to swim in the liquor, we may be assured that the clarifying is complete. Heat is then applied to finish the evaporation and concentration. If the sirop is suspected to be of bad or middling quality, then a test of caustic alkali, well filtered and mixed with lime water must be employed. If the action of these agents causes the appearance of any flakes of feculent matter, then a temper of lime or other alkali is put into the sirop, in proportions regulated by the quantity of the flakes, which, in this case, are always very trifling. They are soon separated by the concurrent action of the temper and heat, which raises them to the surface, whence they are easily removed by the scummer. When the colour of the sirop is a very deep brown, and lime water and alkalis fail to separate any feculencies, it may be presumed that its darkness is, in part, owing to an excess of temper, which holds the mucilage, and sometimes also a portion of the second feculencies, in solution. In this case very diluted sulphuric or oxalic acid may be used as a test, for if the alkali is in excess, either of these acids will precipitate it in the form of a neutral salt, and the acid will also affect the colouring part of the mucilage: the base of this juice is then precipitated in the form of white flakes, and any portion of the second kind of feculencies, which the alkali may have held in solution, is likewise precipitated. To remedy this excess of alkali, very diluted sulphuric acid, or cream of tartar, citric acid, or oxalic acid, may be used. But to employ these different acids with success, a person must be well acquainted with their properties. They may, however, be dispensed with in the method we are now explaining, by being careful to procure good lime, and weighing it with accuracy. While the charge of the first concentrator, and all the contents successively, of the first reservoir, are being concentrated, scumming and evaporating are continued in the three preceding coppers, and the sirop of the evaporator, after being carried to the proper point of concentration, is passed from this copper to the second reservoir, always through the little basin and the canal which communicates with it; this reservoir continues to be thus filled, (always previously passing the sirop through the filters,) till all the contents of the first reservoir are concentrated; this ought to happen at about six or eight o'clock in the evening; at this moment the charge of the evaporator is passed into the concentrator, which is again converted into an evaporator.

If it is requisite, the first reservoir for subsidence is washed, and then it is filled anew, as at first, with the sirop, evaporated in the concentrator to the proper fixed point. The second reservoir is left to subside during the night, and at five o'clock in the morning the boiling of the sirop from this reservoir is begun, similarly to that from the first reservoir on the preceding day. This order once established, it continues always in the same alternation. Thus, in this work, each charge of expressed juice passes from one copper to another without being mixed, and receives, successively, the degrees of heat most proper for its different stages of clarification and evaporation. The temper of each charge can be regulated according to the signs presented by the scum, and to the bubbles formed in ebullition, &c., but to these signs implicit confidence must not always be attached. All the solid matters which have escaped the scummer, are most successfully removed by the filtration and subsidence to which the sirop is subjected, without any increase of labour, since the progress of this method does not require a greater number of negroes than is ordinarily employed in the usual method. The clarifying and evaporating begin almost at the same time, and advance together to the reservoirs for subsidence, where the clarifying is entirely finished. The action of heat upon the feculencies ought to be moderate, a too slow or too rapid heat are both injurious. In these coppers it can be graduated at will, the shape and material being favourable for this desired effect. When once the power of the furnace is known, the charge of the clarifier can be regulated accordingly, by augmenting or diminishing the quantity of the expressed juice in such a manner that it may arrive at the desired point of clarification in the required time.

The sirop is never evaporated to such a density as in any way to injure or obstruct the separation and removal of the feculencies by the scummer. The charge of the first clarifier being from 250 to 370 gallons of juice, and this charge passing entire from one copper to another, the proportion of water which the cane liquor contains, is always great enough to allow free scope to the feculencies to separate and be disengaged by the scummer; for, however rapid the evaporation may be, its progress can be regulated at will to the fixed point for filtration and subsidence.* This point is ascertained by the saccharometer, an instrument formed of a bulb of copper, two or three inches in diameter, attached to a tube six or eight inches in length. This saccharometer is charged with grains of lead, adjusted in such a manner, that, at the 24th degree of Beaume's scale, the bulb, plunged in the fluid, would be just covered to the commencement of the tube. The negro boiler being made acquainted with this point, is charged to watch the work; it may with safety be abandoned during the night to his guidance, as the concentrating only takes place during the day; the negroes have nothing more to do than to weigh the lime for each charge of the expressed juice, which is put into the clarifier, then to scum and pour the cane liquor on the filters. The progress, in the usual method, with iron boilers, has none of these advantages; on the contrary, they have the opposite defects.

After the account we have given of the progress of clarifying, evaporating, and concentrating, in the laboratory, with the four copper boilers, it is easily perceived, that when these three operations in the laboratory are pursued as it is proposed, the different steps of the work will, although divided, be absolutely the same. The concentration performed in a single vessel, over one fire, or in the laboratory with a double furnace, will not, in any way, be different in its execution to that in a laboratory with four coppers; it will only require the attendance of a few more negroes; but in a large plantation it is essential that the work should be performed very rapidly, and therefore its steps should be more divided.

---

* The rapidity of the evaporation can constantly be ascertained by reference to the table, page 206; that, connected with the use of the saccharometer, should regulate the progress.

The cane liquor being now entirely deprived of all solid matters by the means just described, it can be concentrated to the required point, its state being fully ascertained before concentration, and the defect, (if any,) in alkali being easily remedied.

The advantage of concentrating only during the day is very important, as the overseer can thus bestow his attention and care upon the concentration of the whole, without being obliged to watch all night; the operations during this period being reduced to those of clarifying and evaporating, may safely be entrusted to the negro commander or head boiler, who is one of the most trust worthy persons on the plantation.

The proportion of essential salt which the cane liquor contains, cannot by any means be augmented—the sweet and saccharine mucous juices cannot be converted into sugar—nor can the former and the mucilage be removed before the complete concentration of the sirop, since those juices are more soluble than the essential salt. The end proposed then, is to extract the greatest possible quantity of this salt in the best possible state; for this purpose we must borrow the aid of chemistry, the principles of which are much more required in the concentration and crystallization of middling and bad sirop, than in that of good quality. The sweet and saccharine mucous juices, cannot support nearly as high degrees of heat as the essential salt; they are immediately decomposed by the application of degrees of heat, which may safely be used to sirop of good quality. The business of concentration, as we have before observed, is the action of heat upon the water of solution of the sugar. The sugar-boilers, both of America and Europe, have rarely had a just conception of the action of heat in the operation of concentration; their knowledge has generally been confined to some terms, which serve to designate the particular state in which the sirop under concentration is found; the recollection of these terms too often makes up the whole science of the sugar-boiler.

Concentration being the action of heat upon the water of solution, ought necessarily to begin and terminate at fixed degrees of the thermometer. The truth of this position Dutrone affirms to have been demonstrated to him by multiplied experiments, made with solutions of sugar, refined to a state of perfect purity, and to which he applied the action of heat at each degree, commencing at 83°, and ending at 110° of Reaumur. This scale is not in use in England or her colonies, and, therefore, in the following table we have added another column, with the corresponding degrees in the scale of Fahrenheit.

Each of the experiments was made with a solution of one hundred pounds of sugar in sixty pounds of water. When the degree of heat indicated by the thermometer is ascertained, a reference to this table will show, at one glance, what proportion of the water of solution has been evaporated—what quantity of sugar is thereby rendered capable of passing to the solid state—and how much water is yet to be evaporated before the remainder of the sugar can be crystallized. If, for example, during the process of concentration, the thermometer rises to 230° Faht. or 88° Reaumur, this table informs us, that 31 lbs. 3 oz. 4 dr. of water have been evaporated, that 52 lbs. of sugar have thereby been rendered capable of crystallizing, and that 28 lbs. 12 oz. 12 dr. of water remain to be evaporated, before the remainder of the sugar, 48 lbs., can assume the solid form.

Table of the action of heat upon a saturated solution of sugar commencing at the point of saturation, and terminating at the point of perfect crystallization.

Degrees of thermometer.		Water of solution evaporated at each degree.			Products of crystallized sugar at each degree.			Water which remains combined to the sugar in the state of sirop, after the crystallization at each degree.			Sugar which remains combined with the water in the state of sirop at each degree.		
Fahrenheit.	Reaumur.	lbs.	oz.	dr.	lbs.	oz.	dr.	lbs.	oz.	dr.	lbs.	oz.	dr.
219	83	0			0			60			100		
221	84	4	12	14	8			55	3	2	92		
223	85	11	8	14	19	4		48	7	2	80	12	
225.5	86	18			30			42			70		
228	87	24	9	10	41			35	6	6	59		
230	88	31	3	4	52			28	12	12	48		
232	89	33	11	10	56			26	4	6	44		
234.5	90	36	3		60	5		23	13		39	11	
237	91	38	1		63	4		21	15		36	12	
239	92	39	4		66	3		20	12		33	13	
241	93	41	7	10	69	2		18	8	6	30	14	
243.5	94	43	4		72	1		16	12		27	15	
246	95	45			75			15			25		
248	96	46	7	4	77	7		13	8	12	22	9	
250	97	48	7	8	80	5		11	8	8	19	11	
252.5	98	50	1	10	83	3		9	14	6	16	13	
255	99	51			85			9			15		
257	100	52	5	14	87	4		7	10	2	12	12	
259	101	53	1	6	88	6		6	14	10	11	10	
261.5	102	54	1		90	1		5	15		9	15	
264	103	55	3	10	91	4		4	12	6	8	12	
266	104	55	12		92	7		4	4		7	9	
268	105	56	7	10	94	2		3	8	6	5	14	
270.5	106	57	3	8	95	5		2	12	8	4	11	
273	107	58	6	8	97			1	9	8	3		
275	108	58	14	8	98	2		1	1	8	1	14	
277	109	59	7	10	99	2			8	6		14	
279.5	110	60			100								

Although soluble matters, other than the essential salt, are combined with the water of solution, the water is, nevertheless, always united with it in a relative and determinate proportion: the thermometer ought, therefore, to be employed to determine its concentration, the solid product having always relation to the proportion of water which the heat has evaporated at each degree of this instrument. If the extraneous matters exist in a greater abundance, the quantity of pure sugar will be less than that marked in the foregoing table.

The use of the thermometer in concentration, far from excluding the proof of the finger, which is very convenient, serves, on the contrary, to render its practice less equivocal, giving to the operator fixed rules, by which he may be more safely guided.

Sirop, when concentrated beyond the point of solution, assumes, in cooling, the crystalline form: experience shows us that the molecules of similar bodies, in taking this form, require to move freely in the fluid which holds them in solution, in order to their exercising upon each other their mutual attraction. These molecules take, in their union, a form much more regular in proportion as the water, in which they unite themselves, is more considerable. When the mother water exists in a great proportion, compared to the sugar which is to be crystallized, very large and regular crystals are formed; in this state it is called sugar-candy.* We know that salts are much more pure and perfect, as the forms they make approach nearer to those which nature has assigned to them. Sugar-candy is in the most perfect state that can be desired, and the means that it is proper to employ, to extract the essential salt of the cane, ought, therefore, to be founded on this principle of chemistry—*to crystallize in a considerable quantity of water*—a principle fully ascertained and established for all bodies which crystallize in cooling.

[*Repertory of Patent Inventions.*

Remarks on Lotteries.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—Although your journal may not, to some persons, appear to be the proper place to examine the subject of lotteries, yet as it is one which interests the labouring classes in an especial manner, this consideration may probably induce you to allow a page to an operative mechanic to present his cogitations to your readers. I am emboldened to do this from your having published in your July number, the specification of Mr. Jas. K. Casey's patent for what he denominates a *Self-operating Lottery*. It appears to me that the plan proposed by that gentleman, would, if carried into general effect, remove most of the evils which result from the nefarious and beggar making schemes with which our country is inundated, to the utter ruin of thousands among the poor and thoughtless, who are induced to resort to this most pernicious mode of gambling; a mode by which they are swindled out of their hard earnings, to support and enrich some thousands of lottery ticket venders; a class of men who, to say the least, are among the most unproductive class of society. I have taken some pains to investigate the operation of the existing lotteries, and may hereafter, if not anticipated by some abler hand, offer you some calculations which I think will astound every one who has not put himself to the same trouble. No legislature, fully informed of the evil consequences of lotteries as at present constituted, would ever have tolerated so great an evil. In this city, (New York,) I have been gratified to see that a most respectable grand jury has, in effect, presented the present mode of managing and drawing lotteries as a nuisance of a most offensive and pernicious character; and this they have boldly and properly done, although the evil itself is legalized, and cannot, therefore, be immediately suppressed, but must for awhile continue to inflict its mischiefs *in due course of law.* I have somewhere seen it observed that "the worst poison is that which poisons the physic." Are the nostrums of the vilest charlatans, one half so deleterious as the quackery of our lottery puffers?

---

* Crystallizing in a great quantity of water should not be confounded with crystallizing in a great mass, as a planter of St. Domingo did, who had a crystallizing vessel made twenty feet long, ten feet wide, and two deep; the crystallization of sugar, with a proportionate large quantity of water, can be performed in the smallest vessels.

I know that among the contractors for lotteries there are some very respectable men; and do not they, who are so fully aware of the evil, owe it to the community to abate the nuisance, especially if there is any plan by which it can be effected whilst they may make a sufficiently profitable investment of their capital, by embarking it in a scheme which, whilst it would satisfy those who are disposed to make speculative adventures, would protect that class who are now made the wretched dupes of hope forever deferred.

I have no time to analyze *Mr. Casey's self-operating lottery;* it appears to me, however, obviously free from the most crying, if not from all, the evils incident to the existing plan of conducting and *drawing* lotteries. I wish that you, sir, or some other person qualified for the task, would undertake to enlighten the public mind more fully upon this subject, in doing which I am convinced it will be made fully manifest that a more extensive imposition was never practiced or endured. I hardly think it possible to influence the legislatures of all the states in our extensive country to prohibit lotteries altogether. In many places the public will probably continue to call for them, and in this case the question of the greatest importance is, how can this wish be gratified with the least possible inconvenience and loss.

Yours,

A Mechanic.

New York, August 20th, 1831.

Madder, Woad and Barilla.

We observe with pleasure that the Pennsylvania Horticultural society have instituted an inquiry in relation to these important staples; madder is especially interesting to the manufacturers of the United States, and as it is a very desirable object to ascertain how far its cultivation may be safely recommended to the agriculturists of this country, we have pleasure in republishing the circular of the Horticultural society, with a view to call the attention of our distant subscribers to it.

To our city readers we may state that the question has been proposed for discussion at the meeting of the Institute on the 22nd of September.

P. C.

[CIRCULAR.]

Philadelphia, November, 1830.

At a meeting of the Pennsylvania Horticultural Society, held on the 8th instant, the undersigned were appointed a committee to "inquire into and report what progress has been made in this country in the cultivation of dyers' madder, and whether it will be proper for the Horticultural Society to adopt any measures to extend its cultivation." They were also instructed to include in their inquiries, "the culture of Barilla, and its preparation for the purposes of commerce."

Impressed with the importance of the objects committed to their attention, they are desirous of collecting as much information as possible, before they adopt any conclusion upon the questions referred to them. This, they are aware, must depend, in a great measure, upon the liberal communication of facts and observations, on the part of those who are practically conversant with these articles, either as agriculturists, merchants, or manufacturers.

With this view, they respectfully request that you may be pleased to communicate to them such information as you may possess, in relation to the cultivation of either of these plants—to the extent to which they are raised in, or imported into, this country—to the preparation which they undergo to fit them for commerce—to the fluctuations which have been observed in their abundance, and price in our markets—to their adaptation to the soil and climate of this country—to the diversities observed in the qualities of merchantable madder, and barilla, and to the causes which are supposed to produce these diversities—in a word, to every point which can throw light upon this subject.

Being desirous of giving to their investigations the widest range, the committee prefer submitting it to your attention, under this general aspect, than under the more restricted one of formal questions. They hope that the extent to which these plants minister to several useful arts, will be a sufficient inducement to secure the attention of all such as take an interest in the success of our agriculture and manufactures.

Respectfully,

WILLIAM H. KEATING,
SAMUEL BRECK,
MOSES BROWN.
} *Committee.*

N. B. Please direct your communications on this subject to any one of the members of the committee, or to David Landreth, Jr., Corresponding Secretary of the Pennsylvania Horticultural Society.

Although the resolutions of the Society are restricted to the above mentioned plants, yet we shall be obliged to you if you annex any information you may possess on the subject of *Woad.*

Account of some experiments made at Mr. Laird's works, at North Bickenhead, with the New Low Pressure Boiler, on the exhausting principle of Messrs. Braithwaite and Ericsson, by ALEXANDER NIMMO, *C. E., Dublin, and* CHARLES B. VIGNOLES, *C. E., London.*

THE exhausting apparatus consisted of a fan wheel, with broad radial leaves, revolving within a close box or chamber, placed a little apart from the boiler, but connected with it by a passage leading from the flues traversing the boiler; a short tube above the exhausting chamber passed out to the atmosphere.

The furnace was attached to, and placed at the end of, the boiler, opposite to the exhausting apparatus, which latter being put to work, drew through all the turns of the boiler the hot air from the fire, which passed over the throat of the furnace through the bridge flue, and then successively through the other five turns of the flue arranged through the boiler, and, finally, was drawn through the exhausting chamber, and passed into the atmosphere.

The heat, which in the furnace was extremely intense, was absorbed by the water in the boiler, as the air rushed through the flues, and when passing up the tube or funnel from the exhausting chamber, was so far cooled that the hand and arm might be placed with impunity down the tube, the temperature not exceeding 180° Fahrenheit.

Not the slightest smoke was perceptible.

The following are the principal dimensions measured:—

	Ft. In.		Ft. In.	
Furnace.	2 0 deep.	Ash Pit.	1 0 deep.	The openings of the fire-bars equal to about half the area of the bottom.
	2 6 long.		2 6 long.	
	2 6 wide.		2 6 wide.	

	Ft. In.			
Exhausting Chamber.	2 6 high.	Outside dimensions.	Diam. of exhausting wheel, - - -	3 0
	3 6 wide.		Breadth of the same,	0 10
	3 6 long.			

Bridge flue or throat, from the furnace, 2 ft. 6 in. broad, 4 in. wide, 2 ft. deep - - - - - -	5—16 in. iron plates.
First turn of the flue, 4 in. wide, 2 ft. deep, 2nd, 3d, 4th, and 5th turns, 3 in. wide, 2 ft. deep, - - - - - - - - -	¼ in. iron plates.
Whole length of the flues through the boiler,	45 feet.
Superficial area of the heating surface, -	247 square feet.

The contents of the water in the boiler, when filled, were from	85 to 90 cubic feet.
The superficial area of the evaporating surface, nearly	33 square feet.
The proportion of the heating to the evaporating surface, nearly	7½ to 1.

Steam Chamber.	3 ft. wide. 4 ft. 10 in. average depth. 4 ft. 6 in. long.	Containing about 65 cubic feet.

Diameter of the safety valve, very nearly 5 inches; being 19 square inches area, which was loaded for a pressure of 4 lbs. on the square inch, giving 76 for the load. Of this, 66 lbs. of iron was placed in the boiler, and 10 lbs. allowed as the weight of the valve, rod, hook, handle, &c.

The water used was the salt water from Wallasey Pool, and filled into a large iron tank, the area of the surface of which measured 32½ superficial feet.

The boiler was placed upon an open shed; the day was very cold, with thick rain. No engine being attached to the boiler, the exhausting apparatus was worked by a wheel and band from Mr. Laird's turning engine. The velocity of the circle of percussion of the leaves of the exhausting wheel, was determined to be about 77 feet per second, or upwards of 52 miles an hour. Mr. Laird's engine is stated to be a 4 horse power. No determinate measurement was made, but the engineers present computed, that the power applied to turn the exhausting wheel, was equal to that of two horses.

The fire being lighted, the steam was got up to 4 lbs. pressure in 45 minutes, with a consumption of 2½ cwt. of coke. The expenditure at first was 8 lbs. per minute, and gradually decreased to 5 lbs.; averaging about 6¼ lbs. per minute for getting up the steam. The steam began to rise in 27 minutes, after which the consumption of coke was little more than 5 lbs. per minute; and at this period there would have been a sufficient supply of steam to work the cylinders of an engine.

The coke employed was gas coke, of very bad quality, of which 3½ cubic feet weighed 105 lbs. giving 30 lbs. for the weight of a cubic foot, or 3000 lbs. as the weight of 100 cubic feet. The same weight of St. Helen's coal, (that principally used in steamboats,) measured 63 cubic feet. The cost of the coke used was 8*s.* 6*d.* per ton, delivered in Liverpool; the cost of Smithy coke being 25*s.* per ton, of which 3½ cubic feet weighs 115 lbs., giving very nearly 33 lbs. for the weight of a cubic foot.

When the steam was up, the water in the thick glass gauge attached to the boiler, standing at 7½ inches, the two men stationed for the purpose began to pump, a fresh supply of weighed fuel was placed on the floor, and the following observations were made:—

	Hours.	Min.	
At	3	32	began to pump.
At	3	54	—16 cubic feet of water were evaporated.
At	4	12	—27 cubic feet of water were evaporated.

Hours. Min.
At 4 19—38 cubic feet of water were evaporated; and 2 cwt. of coke consumed.
At 4 32—41½ cubic feet of water were evaporated, with a consumption of 252 lbs. of coke.

From which it appears, that only 6 lbs. of coke per cubic foot of water per hour was consumed, and the evaporation of a cubic foot of water per hour being generally considered the measure of a horse power, the conclusion is, that the boiler was a 40 horse boiler, and that the quantity of fuel requisite to work it is 2½ cwt. per hour, the expense of which is 12¾*d.* and as the consumption diminishes after the first hour, the expense of fuel will probably not exceed 1*s.* per hour for the forty horse boiler.

(Signed,)
ALEXANDER NIMMO, C. E.
CHARLES B. VIGNOLES, C. E.

Oil for Chronometers.—By Mr. HENRY WILKINSON, *of Pall Mall.*

From the Transactions of the Society of Arts.

THE best olive oil in its recent state possesses that peculiar bland flavour which fits it for the table, and which appears to arise principally from the quantity of mucilage and water, either held in solution, or mechanically mixed with it. By keeping one or two years in jars, a considerable portion of the mucilage and water *subsides*, which renders such oil not only cheaper, but better qualified for yielding a greater proportion of *pure* oil than that which is recently expressed from the fruit. Two or three gallons skimmed from the surface of a large jar that has remained at rest for twelve months or upwards, is preferable to any succeeding portion from the same jar, and may be considered the cream of the oil. Having procured good oil in the first instance, put about one gallon into a cast iron vessel capable of holding two gallons; place it over a slow clear fire, keeping a thermometer suspended in it; and when the temperature rises to 220°, check the heat, never allowing it to exceed 230°, nor descend below 212°, for one hour, by which time the whole of the water and acetic acid will be evaporated: the oil is then exposed to a temperature of 30° to 36° for two or three days, (consequently winter is preferable for the preparation, as avoiding the trouble and expense of producing artificial cold; by this operation a considerable portion is congealed; and, while in this state, pour the whole on a muslin filter, to allow the fluid portion to run through; the solid, when redissolved, may be used for common purposes. Lastly, the fluid portion must be filtered once or more through newly prepared animal charcoal, grossly powdered, or rather broken, and placed on bibulous paper in a wire frame, within a funnel; by which operation rancidity, (if any be present,) is entirely removed, and the oil is rendered perfectly bright and colourless.

HENRY WILKINSON.

Bibliographical Notices.

It has long been our design to give not merely a list of new publications relating to the useful arts, general science, internal improvements, and popular education, but occasionally to accompany the notice of them with such remarks as shall indicate our own opinion of their merits. In a work like the Journal of the Franklin Institute, reviews of this kind must necessarily be brief; we, however, shall treat such publications as may come under our notice with the same freedom and candour as have characterized our analysis of new patents. We shall be obliged by any aid given to us in our undertaking by the readers of this Journal; for, although situated in the political metropolis of the United States, we are without the means of a resort to Athenæums, Libraries, and Reading Rooms, such as exist in Philadelphia, New York, and Boston, where the new publications which would properly come within our province may always be found.

We are frequently asked what books we would recommend as best calculated for the instruction of those who wish to obtain information respecting the useful arts generally; and for the satisfaction of such persons we may occasionally advert to works of merit, which although they may have been for some time before the public, are not so extensively known as they deserve to be.

We know of some editors who have a happy talent at commending almost every work placed upon their desks by the kindness of authors or publishers; we shall be very glad to receive works in this way, but when we read, and more especially when we write about them, we shall be very apt to forget that they have been presented to us, and to sin against the old proverb which forbids our "looking a gift horse in the mouth." We hope, however, never to forget that courtesy which is always due to kind intentions; and will ever bear in mind that wantonly to wound the feelings of others is not the less a crime because it is one which is frequently committed.

The Introductory Discourse and Lectures delivered in Boston, before the Convention of Teachers, and other friends of Education, assembled to form the American Institute of Instruction. Boston, Hillard, Gray, Little & Wilkins, 8mo. pp. 352.

It is delightful to witness the public excitement which exists upon the subject of general education, and to see the wisest heads, and ablest hands, employed in directing the use of this most important of the instruments of public virtue, liberty, and happiness. The work before us consists of an Introductory Discourse by the Rev. President Waylard, of Browne University, and of thirteen Lectures upon various subjects intimately connected with education, delivered before a convention assembled in Boston, in August, 1830, for the purpose of forming an *American Institute of Education*. The lectures are—On Physical Education, by John C. Warren, M. D.—On the Development of the Intellectual Faculties, and on Teaching Geography, by James G. Carter—On the Infant School System, by William Russell—On the Spelling of Words, and a rational method of teaching their meaning, by Gideon F. Thayer—On Lyceums and Societies for the Diffusion of Useful Knowledge, by Nehemiah Cleavland—A Practical Method of Teaching Rhetoric, by Samuel P. Newman—On Geometry and Algebra, by F. J. Grund—On the Monitorial System, by Henry K. Oliver—On Vocal Music, by William C. Woodbridge—On Linear Drawing, by Walter R. Johnson—On Arithmetic, by Warren Colburn—On Classical Learning, by Cornelius C. Felton—On the Construction and Furnishing of School Rooms, and on School Apparatus, by William J. Adams.

These lectures were prepared during those hours which are ordinarily given to relaxation, by gentlemen engaged in the arduous business of teaching. There is, of course, much variety of style, as well as diversity of subject, but they are all highly practical in their tendency; and the teacher who can rise from the perusal of them without having increased his stock of information, must have commenced the task with his measure of capacity already filled, or altogether incapable of retention.

It is not to teachers alone that the work addresses itself. The admirable lecture of Dr. Warren on Physical Education, and indeed several of the others, afford useful lessons to every one engaged in forming the moral and physical habits of the rising generation.

The Working Man's Companion, Part 1.—*The Results of Machinery, namely, Cheap Production, and Increased Employment, exhibited, being an Address to the Working Men of the United Kingdom.*—Philadelphia, republished by Carey and Hart, 18mo. pp. 216, 37½ cents.

We have recently published large extracts from this very excellent production, and our readers, therefore, have had an opportunity to form a judgment of its merits. The subject upon which it treats had occupied much of our attention, but we have derived more information from the perusal of this little work, than from all our previous inquiries, and we recommend the reading of it to every one interested in the progress of the mechanic arts—and who is not?

The Working Man's Companion will consist of a series of works; which will be published in a neat manner, and at a very low price.

The American Library of Useful Knowledge. Published by authority of the Boston Society for the Diffusion of Useful Knowledge, Vol. 1. Boston, 12mo. pp. 320, 75 cents.

This, like the preceding work, is to be continued by the occasional publication of other volumes, intended to form a well assorted popular library; consisting, in part, of original productions, and in part of a reprint of the most meritorious of those which appear in England.

The present volume comprises a Discourse delivered by Judge Story before the Boston Mechanics' Institution—A Lecture delivered before the same Institution, by the Hon. Daniel Webster—An Essay on the importance to Practical Men, of Scientific Knowledge, and on the Encouragements to its pursuits, by the Hon. Edward Everett—A Lecture to the Working Men's Party, by the same—Dissertation on the Objects, Advantages, and Pleasures of Science, by Lord Chancellor Brougham—An account of Lord Bacon's Novum Oraganon Scientarium, or New Method of Studying the Sciences—A Discourse on the Nature and Advantages of the Study of the Physical Sciences, Part 1, by J. F. W. Herschell, Esq.

This is a neat, compact, and highly valuable volume. The names and talents of the writers of the respective pieces are so well known, that any commendation from us would not be merely superfluous, but might justly be considered as a mark of vanity. If its diffusion be commensurate with its merits, there are few volumes which will be more generally read.

New Conversations on Chemistry, adapted to the present state of that Science; wherein its elements are clearly and familiarly explained; with one hundred and eighteen engravings, illustrative of the subject: Appropriate Questions; a List of Experiments, and a Glossary. On the foundation of Mr. Marcet's "Conversations on Chemistry." By Thos. P. Jones, M. D. Philadelphia, John Grigg, 12mo. pp. 332, $1 25.

The Editor undertook this work with the design of introducing such improvements in the well known "Conversations on Chemistry," as were rendered necessary by the numerous and great discoveries made in that science, but in the prosecution of this intention he soon found that it would be more easy to produce a book which should be essentially new, than to remodel the original. His great aim has been to furnish a work which should be both comprehensive and familiar. A Conversation on the Steam Engine has been introduced, which, it is hoped, will enable any one who peruses it with attention, to understand the leading principles upon which the action of that instrument depends.

Meteorological Observations for August, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
☾	1	72°	80°	29.94	30.00	72	W. W.	Moderate.		Cloudy—flying clouds.
	2	75	84	.42	29.50	73	SW.	do.		Cloudy—rain in night.
	3	72	84	.70	.86	68	SW.	do.	.12	Clear day.
	4	64	73	.80	.80	60	NW.	do.		Clear—cloudy.
	5	61	76	.78	.80	58¼	NW.	do.		Cloudy day.
	6	64	75	.83	.90	55	NW.	do.		Cloudy day.
⊗	7	65	73	.86	.86	64	NE.	do.	.6	Cloudy—rain.
	8	63	65	.86	.80	62	NE.	Gale.	1.12	Cloudy—rain.
	9	70	74	.88	.93	68	NE.	Calm.	1.11	Rain.
	10	70	78	30.10	30.10	70	W.	Light.		Cloudy—clear.
	11	70	78	.10	.5	67	N. SW.	Calm.		Cloudy day.
	12	71	81	.00	29.97	63	SW. NW.	Moderate.		Cloudy—clear.
	13	67	82	.2	30.00	63	NW.	do.		Clear—overcast.
	14	68	83	29.97	29.91		W.	do.		Clear day.
☽	15	71	86	.86	.75	69	NW.	do.		Clear day.
	16	73	87	.87	.87	70	W.	do.		Clear day.
	17	75	85	.90	.90	70	W.	do.		Clear day.
	18	75	87	.96	.96	70	SW.	do.	.10	Clear day.
	19	73	86	.96	30.00	70	W.	Calm.		Clear day.
	20	74	84	.96	29.96	70	SW.	Breeze.		Clear day.
	21	75	85	.90	.90	69	SW.	do.		Clear day.
	22	75	86	.86	.86	69	SW.	do.	.26	Cloudy—clear.
🌝	23	75	84	.86	.90	70	SW.	Moderate.		Cloudy—clear.
	24	68	87	30.00	30.03	70	SW.	Calm.	.75	Cloudy day.
	25	72	78	.3	.3	72	W.	do.	.70	Drizzling—cloudy.
	26	74	84	30.00	29.90	73	S.	Moderate.	.5	Cloudy—showery.
	27	71	72	29.86	.87	68	NW.	Calm.	.40	Drizzling—showery.
	28	63	72	.90	30.03	48	NW.	Breeze.		Clear day.
	29	57	70	30.14	30.14	47	NE.	Moderate.		Clear day.
	30	60	76	.13	30.00	46	W.	do.		Clear day.
	31	61	76	.3	30.00	59	NE.	do.		Clear—overcast
	Mean	69.16	79.90	29.91	29.92	65.1			4.67	

		Thermometer.	Barometer.
Maximum height during the month,		87. on 16th, 18th & 24th	30.14 on 29th.
Minimum	do. . .	57. on 29th.	29.42 on 2nd.
Mean	do. . .	74.53 . . .	29.90

ERRATA.

The following references to the wood cut of Smith's revolving plane should have been inserted at page 162.

A, Belt wheel used by hand power on small machines—the belt passing over the pulley which is placed upon the axis of the plane wheel.

B, The plane wheel, into which the irons are fixed in such shape and number as the work requires.

C, The piece of timber to be planed or wrought upon, which is placed upon the carriage and secured by dogs or holdfasts.

D, The carriage moved by a rack of iron attached to the bottom part.

E, The cog wheel that moves the carriage.

F, The dogs or holdfasts.

G, The pulleys, of different sizes, placed upon an axis that moves the pinion wheel forward—and backward, by a cross band.

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

OCTOBER, 1831.

Description of an economical and delicate Balance; invented by WM. RITCHIE, *F. R. S. Communicated by* D. STROBEL, *Esq., Civil Engineer.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—An economical, and at the same time very delicate, balance, for the determination of specific gravities, and the prosecution of chemical investigation in general, has hitherto, I believe, been deemed a desideratum;—under this impression, I send you the description of one, possessing these advantages in an eminent degree, and which, I have little doubt, will prove acceptable, if not useful, to many of your readers.

The instrument I am about to describe is the contrivance of a very learned and talented scientific gentleman, Mr. William Ritchie, M. A. F. R. S., whose acquaintance I had the pleasure to make, at Paris, in the year 1826, and is one amongst many other highly ingenious inventions of his, which he was kind enough to communicate to me.

The annexed sketch represents one of these balances—A, B, Fig. 1, is the beam, which is made of two slender pieces of any light sort of wood, sprung together at each end, and kept asunder in the middle by means of a wooden piece, C. These three pieces are to be well glued or otherwise securely fastened to each other. Through the end of each arm of the beam, and also through the centre of the piece C, is to be driven tight a small piece of hardened steel, formed like the straight part of an ordinary penknife blade, and of a length sufficient to project on each side one-quarter or one-third of an inch. These blades, or knife edges, are to be fixed, as nearly as may be, equidistant from the centre, though any great nicety in this adjustment is quite unimportant, as we shall see presently. The edges of the blades should be situated nearly in the same horizontal plane, and must be elevated a little above the centre of gravity of the beam, for reasons which are too well known to be repeated here. The fulcrum of the balance rests upon two pieces of thermometer tube, each about half an inch in length, and drawn out in the flame of a lamp so as to reduce their diameter in the middle as shown at Fig. 2. These bits of tube are cemented with sealing wax into two grooves sunk in each side of a forked piece of wood, (see Fig. 3,) forming the upper extremity of a column, which serves as a stand for the instrument. The scale hooks are also formed of thermometer tube, and are represented at Fig. 4. Fig. 5 shows one of the knife edges.

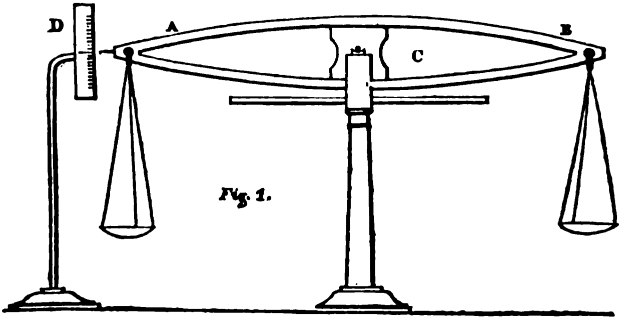
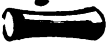


Fig. 2.



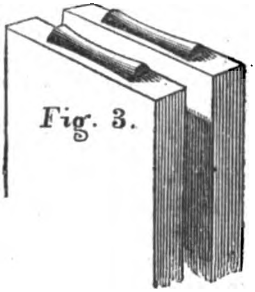


Fig. 3.

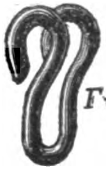
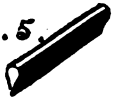


Fig 4.

Fig. 5.



In using this balance for taking the specific gravity of bodies, or for any other purpose, we must always operate in the manner first pointed out, (if I recollect rightly,) by the Chevalier Borda; that is, the substance to be weighed is to be put into one of the scale pans and accurately counterpoised by means of small shot, metallic filings, &c. contained in the other; when this has been effected, the substance is to be removed from the scale, and its place supplied by known weights which are added until an equilibrium is obtained. By operating in this manner, that perfect equality in the two arms of the lever, (so difficult to arrive at in practice,) becomes evidently of no moment, as has already been remarked in describing the instrument.

From the exceeding lightness of the beam, and the very small extent of touching surface between the knife edges and their glass supports at the points of contact, it will readily be conceded that the friction must necessarily be less than in balances of the ordinary construction; its accuracy will be therefore superior, whilst it may probably be constructed, in most places, for the hundredth part of their cost.

In conclusion, it will perhaps be proper to observe, that in operating with this instrument, when it has been properly adjusted, it will be found to vibrate for a very considerable time before coming to rest; an additional proof of its great delicacy, but which, on most occasions, would be found rather tedious: to obviate this inconvenience, the ingenious inventor inserted in the end, A, of the beam, (Fig. 1,) a common sewing needle, which, when the beam was in a horizontal position, pointed towards the middle of a small piece of pasteboard, D, whereon was traced a number of equi-distant lines, the spaces between which, for distinction sake, I shall call *degrees:* The middle division was marked zero, and the others 1, 2, 3, &c., increasing from zero both upwards and downwards. This piece of pasteboard was affixed to a small stand, as shown in the drawing. The following is Mr. Ritchie's method of using this apparatus; after the substance has been counterpoised, the beam must be suffered to vibrate, and the number of degrees through which the needle passes, both above and below zero, be noted; we must then remove the substance and substitute weights in its stead, until the needle vibrates between the identical divisions it previously did; by this means we get rid of the inconvenience above alluded to, and arrive at results equally accurate with those we should have obtained by suffering the beam to come to rest.

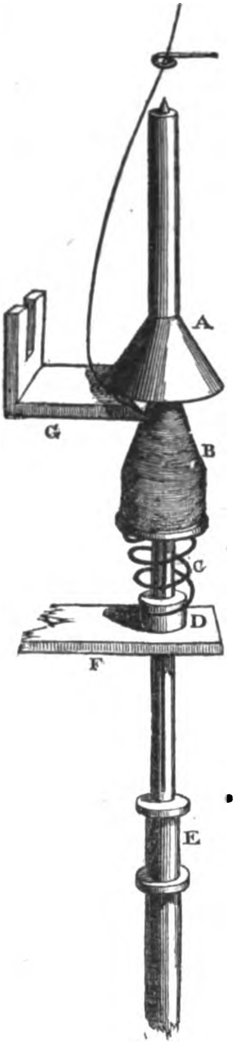
I am, sir, very respectfully,
Your most obedient servant,
D. STROBEL, Jr.
New York, September 1st, 1831. *Engineer.*

Note.—One of the above described balances was compared, in the laboratory of Gay Lussac, with those made by the most eminent workmen, and was found to equal them in sensibility and accuracy. —EDITOR.

A description of Thorp's improved Running Cap Spinner, with a drawing showing its proper construction for spinning into a shuttle bobbin. Published by request of the patentee.

AT page 388, vol. vi. we inserted a specification of a patent for improvements on the running cap spinner, accompanied by drawings. It was the design of Mr. Thorp to have had an engraving of the spindle as now presented, on the plate which accompanied his specification, but the drawing was not received until too late for the engraver: we have therefore had the present cut made to remedy this omission.

Thorp's Running Cap Spinner.



A, is a tunnel formed of sheet iron, brass, tin, or any other suitable substance. Its nosle is generally made of an equal diameter throughout, although this is not absolutely necessary. The cavity of said nosle ought to be no longer than is sufficient to allow the body of the bobbin to traverse up into it without interference.

It is supported at the top of the spindle by a conical socket which suits the taper of the spindle, and is held down to its place by a pin which passes entirely through said nosle, occupying a part of its conical hollow. One side of the tapered part of the spindle is scarfed off so as to allow the pin and nosle to go down to a proper bearing, and is there held by an oblique or horizontal notch, which is formed in one side of said scarf level, with the pin, and in which the pin hitches. The diameter of the brim of the tunnel should be considerably larger than that of the bobbin or roll of yarn, so as to admit the check within the brim, without interfering with the bobbin or yarn. B, is the roll of yarn on the bobbin. C is a conical spiral spring used for the purpose of allowing the bobbin to be pressed down when piercing the yarn. The upper end of this spring is confined to a thin plate of sheet iron, brass, or tin. Said plate is a small size larger than the head or base of the bobbin, so as to be taken hold of without interfering with the bobbin. This plate is perforated in the centre, and loosely encompasses the spindle. It has a tube extending up into the bobbin a short distance, or it may be made dishing, so that the base of the bobbin which sets on it, will find a sufficient friction from which to receive motion. In case of piercing the yarn when the bobbin is at its highest elevation, the plate is taken hold of and pressed down for that purpose. The lower end of the spring is confined to the thimble D, which thimble supplies the place of the collar described in the former publication, to which reference may be had. E, is the box that forms the upper bearing of the spindle. G, the check. F, the lifter on which the above named thimble sets.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

(Continued from p. 153.)

TABLE G.—PART I.

CHUTE NO. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of Bkt.	Btm. of Bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	9.34	11.27	12.56	0.50	463	48.05	511.05	41.5	30	13.02	2350	23.00	540500	212085	.392			
2					669	51.61	720.61		33	11.84	2820		648600	299053	.460			
3					772	53.39	825.39		35	11.16	3100		713000	342536	.480			
4					875	55.17	930.17		44	9.88	3475		799250	386020	.484			
5					978	56.95	1034.95		45	8.70	3770		867100	429504	.494	.494	8.70	
6					1081	58.73	1139.73		52	7.52	4200		966000	472987	.489			
7					1184	60.51	1244.51		56	6.98	4700		1081000	516471	.477			
8					1287	64.88	1351.88		63	6.20	5200		1196000	561030	.469			
9					1390	69.25	1459.25		63	6.20	5640		1297200	605588	.466			
10					1493	73.62	1566.62		65	6.01	6000		1380000	650146	.471			
11					1596	77.99	1673.99		69	5.66	6425		1477750	694705	.463			
2					1699	82.36	1781.36		80	4.88	7200		1656000	739263	.447			
13	9.34	11.27	12.56	0.75	772	53.39	825.39	41.5	27	14.48	3325	23.00	764750	342536	.447			
14					875	55.17	930.17		30	13.02	3525		810750	386020	.475			
15					978	56.95	1034.95		33	11.84	3850		885500	429504	.487			
16					1081	58.73	1139.73		35	11.16	4075		937250	472987	.504			
17					1184	60.51	1244.51		40	9.77	4425		1017750	516471	.507			
18					1287	64.88	1357.88		41	9.54	4780		1099400	561030	.510			
19					1390	69.25	1459.25		44	8.88	5140		1182200	605588	.512	.512	8.88	
20					1493	73.62	1566.62		47	8.32	5585		1284550	650146	.505			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE G.—PART II.

CHUTE No. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	9.34	11.27	12.56	0.75	1596	77.99	1673.99	41.5	53	7.38	6100	23.00	1403000	694705	.495			
22					1699	82.36	1781.36		56	6.98	6575		1512250	739263	.488			
23					1802	86.73	1888.73		57	6.86	7100		1633000	783823	.485			
24					1905	91.10	1996.10		63	6.20	7520		1729600	828381	.472			
25					2008	95.47	2103.47		68	5.76	8100		1863000	872939	.467			
26					2111	99.84	2210.84		73	5.35	8625		1983750	917498	.456			
27					2214	104.21	2318.21		80	4.88	9375		2156250	962056	.446			
28	7.09	9.02	10.31	0.50	463	48.05	511.05	41.5	30	13.02	2400	20.75	498000	212085	.425			
29					566	49.83	615.83		32	12.20	2670		554025	255569	.461			
30					669	51.61	720.61		38	10.28	2910		603825	299053	.495			
31					772	53.39	825.39		43	9.09	3220		688150	342536	.509			
32					875	55.17	930.17		47	8.32	3575		741312	386020	.520	.520	8.32	
33					978	56.95	1034.95		56	6.98	4035		837262	429504	.513			
34					1081	58.73	1139.73		63	6.20	4550		944125	472987	.500			
35					1184	60.51	1244.51		67	5.84	5025		1042687	516471	.495			
36					1287	64.88	1351.88		72	5.43	5525		1156437	561030	.485			
37					1390	69.25	1459.25		80	4.88	6100		1265750	605588	.478			
38					1493	73.62	1566.62		90	4.34	6700		1390250	650146	.467			
39					1699	82.36	1781.36		103	3.79	7700		1597750	739263	.462			
40					1905	91.10	1996.10		112	3.49	8860		1838450	828381	.450			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE G.—PART III.

CHUTE No. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
41	7.09	9.02	10.31	0.75	978	56.95	1034.95	41.5	36	10.86	3920	20.75	813400	429504	.527			
42					1081	58.73	1139.73		38	10.28	4175		866312	472987	.546			
43					1184	60.51	1244.51		41	9.53	4530		939975	516471	.549	.549	9.53	
44					1287	64.88	1351.88		46	8.50	4975		1032312	561030	.543			
45					1390	69.25	1459.25		50	7.82	5475		1136062	605588	.533			
46					1493	73.62	1566.62		53	7.37	5975		1239813	650146	.524			
47					1596	77.99	1673.99		58	6.73	6400		1328000	694705	.523			
48					1699	82.36	1781.36		60	6.51	6930		1438975	739263	.513			
49					1802	86.73	1888.73		67	5.83	7450		1545875	783823	.506			
50					1905	91.10	1996.10		74	5.28	8050		1670375	828381	.495			
51					2008	95.47	2103.47		82	4.77	8700		1805250	872939	.483			
52					2111	99.84	2210.84		86	4.54	9228		1914187	917498	.479			
53	7.09	9.02	10.31	1.00	1081	58.73	1139.73	41.5	31	12.60	4350	20.75	902625	472987	.527			
54					1184	60.51	1244.51		32	11.84	4650		964870	516471	.535			
55					1287	64.88	1351.88		36	10.86	5000		1037500	561030	.541			
56					1390	69.25	1459.25		38	10.28	5350		1110125	605588	.545			
57					1493	73.62	1566.62		40	9.77	5675		1177562	650146	.551			
58					1596	77.99	1673.99		43	9.09	6025		1250187	694705	.555	.555	9.09	
59					1699	82.36	1781.36		45	8.69	6475		1343562	739263	.550			
60					1802	86.73	1888.73		51	7.66	7000		1452500	783823	.539			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE G.—PART IV.

CHUTE No. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
61	4.09	6.02	7.31	0.50	566	49.83	615.83	41.5	40	9.77	2775	17.75	481687	255569	.530			
62					772	53.39	825.39		53	7.38	3475		616812	342536	.555	.555	7.38	
63					875	55.17	930.17		63	6.20	3975		705562	386020	.546			
64					978	56.95	1034.95		70	5.58	4460		791650	429504	.542			
65					1081	58.73	1139.73		75	5.21	4900		869750	472987	.543			
66					1184	60.51	1244.51		83	4.71	5400		958500	516471	.539			
67					1287	64.88	1351.88		100	3.91	6025		1069437	561030	.524			
68					1390	69.25	1459.25		102	3.83	6550		1162625	605588	.524			
69					1493	73.62	1566.62		109	3.59	7025		1246937	650146	.521			
70	4.09	6.02	7.31	0.75	669	51.61	720.61	41.5	37	10.56	3150	17.75	559125	299053	.534			
71					772	53.39	825.39		39	10.02	3450		612375	342536	.559			
72					875	55.17	930.17		42	9.31	3725		661187	386020	.584			
73					978	56.95	1034.95		45	8.70	4075		723312	429504	.593			
74					1081	58.73	1139.73		51	7.66	4450		789875	472987	.598			
75					1184	60.51	1244.51		51	7.66	4800		852000	516471	.606	.606	7.66	
76					1287	64.88	1351.88		62	6.30	5350		949625	561030	.590			
77					1390	69.25	1459.25		65	6.00	5800		1029500	605588	.588			
78					1493	73.62	1566.62		73	5.35	6400		1136000	650146	.574			
79					1596	77.99	1673.99		77	5.07	6950		1233625	694705	.562			
80					1699	82.36	1781.36		83	4.71	7500		1331250	739263	.555			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE G.—PART V.

CHUTE No. 3.—*Elbow buckets. Close breast. Bottom of gate 13.66 feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
81	4.09	6.02	7.31	1.00	875	55.17	930.17	41.5	36	10.86	3800	17.75	674500	386020	.572			
82					978	56.95	1034.95		38	10.28	4125		732187	429504	.586			
83					1081	58.73	1139.73		42	9.31	4500		798750	472987	.591			
84					1184	60.51	1244.51		43	9.09	4825		856437	516471	.603			
85					1287	64.88	1351.88		47	8.32	5225		927437	561030	.605	.605	8.32	
86					1390	69.25	1459.25		52	7.52	5700		1011750	605588	.598			
87					1493	73.62	1566.62		57	6.85	6225		1104937	650147	.588			
88					1596	77.99	1673.99		60	6.50	6650		1180375	694705	.588			
89					1802	86.73	1888.73		71	5.50	7725		1371187	783822	.571			
90					2008	95.47	2103.47		82	4.77	8900		1579750	872939	.552			
91	1.09	3.02	.31	0.75	566	49.83	615.83	41.5	49	7.98	2850	14.75	420375	255569	.608			
92					669	51.61	720.61		62	6.30	3250		479375	299053	.624			
93					772	53.39	825.39		64	6.10	3650		538375	342536	.636	.636	6.10	
94					875	55.17	930.17		73	5.35	4150		612125	386020	.630			
95					978	56.95	1034.95		81	4.83	4650		685875	429504	.626			
96					1081	58.73	1139.73		87	4.49	5175		763312	472987	.619			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE G.—PART VI.

CHUTE No. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
97	1.09	3.02	4.31	1.00	772	53.39	825.39	41.5	51	7.66	3675	14.75	542062	342536	.631			
98					875	55.17	930.17		61	6.40	4100		604750	386020	.638			
99					978	56.95	1034.95		62	6.30	4500		663750	429504	.647	.647	6.30	
100					1081	58.73	1139.73		70	5.58	5000		737500	472987	.641			
101					1184	60.51	1244.51		81	4.83	5500		811250	516471	.636			
102					1287	64.88	1351.88		88	4.44	6000		885000	561030	.633			
103					1390	69.25	1459.25		90	4.35	6500		958750	605588	.631			
104	1.09	3.02	4.31	1.25	1081	58.73	1139.73	41.5	60	6.50	4900	14.75	722750	472987	.654			
105					1184	60.51	1244.51		63	6.20	5325		785437	516471	.657			
106					1287	64.88	1351.88		69	5.66	5775		851812	561030	.658	.658	5.66	
107					1390	69.25	1459.25		74	5.28	6325		932937	605588	.649			
108					1493	73.62	1566.62		82	4.77	6875		1014062	650147	.641			
109					1596	77.99	1673.99		90	4.35	7375		1087812	694705	.641			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE H.—PART I.

[CHUTE No. 3.—*Centre buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	9.34	11.27	12.56	0.50	669	51.61	720.61	41.5	39	10.02	3000	23.00	690000	299053	.433			
2					772	53.39	825.39		42	9.31	3275		753250	342536	.454			
3					875	55.17	930.17		46	8.50	3625		833750	386020	.462	.462	8.50	
4					978	56.95	1034.95		49	7.98	4085		939550	429504	.457			
5	9.34	11.27	12.56	0.75	669	51.61	720.61	41.5	27	14.48	3200	23.00	736000	299053	.406			
6					875	55.17	930.17		34	11.50	3625		833750	386020	.462			
7					1081	58.73	1139.73		36	10.86	4250		977500	472987	.484	.484	10.86	
8					1184	60.51	1244.51		41	9.54	4650		1069500	516471	.483			
9					1287	64.88	1351.88		45	8.71	5075		1167250	561030	.480			
10					1390	69.25	1459.25		50	7.82	5600		1288000	605588	.470			
11					1493	73.62	1566.62		60	6.50	6235		1434050	650146	.453			
12	9.34	11.27	12.56	1.00	1493	73.62	1566.62	41.5	40	9.77	5575	23.00	1282250	650147	.507	.507	9.77	
13					1596	77.99	1673.99		42	9.31	6050		1391500	694705	.499			
14	7.09	9.02	10.31	0.50	566	49.83	615.83	41.5	40	9.77	2800	20.75	581000	255569	.436			
15					669	51.61	720.61		43	9.09	3125		648437	299053	.451			
16					772	53.39	825.39		48	8.14	3475		721062	342536	.475	.475	8.14	
17					875	55.17	930.17		56	6.98	3930		815475	386020	.472			
18					978	56.95	1034.95		61	6.40	4400		913000	429504	.470			
19					1081	58.73	1139.73		69	6.66	4900		1016750	472987	.465			
20					1184	60.51	1244.51		75	5.21	5535		1148512	516471	.449			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE H.—PART II.

CHUTE No. 3.—*Centre buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt. of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	7.09	9.02	10.31	0.75	875	55.17	930.17	41.5	36	10.86	3800	20.75	788500	386020	.489			
22					978	56.95	1034.95		38	10.28	4110		852825	429504	.503			
23					1081	58.73	1139.73		43	9.09	4500		933750	472987	.506	.506	9.09	
24					1184	60.51	1244.51		51	7.66	4975		1032312	516471	.500			
25					1287	64.88	1351.88		63	6.20	5725		1187937	561030	.472			
26	7.09	9.02	10.31	1.00	1081	58.73	1139.73	41.5	35	11.16	4435	20.75	920262	472987	.514			
27					1184	60.51	1244.51		39	10.02	4800		996000	516471	.518			
28					1287	64.88	1351.88		43	9.09	5225		1084187	561030	.517			
29					1390	69.25	1459.25		46	8.50	5575		1156812	605588	.523	.523	8.50	
30					1493	73.62	1566.62		50	7.82	6225		1291687	650147	.503			
31					1596	77.99	1673.99		56	6.98	6725		1395437	694705	.498			
32	4.09	6.02	7.31	0.75	978	56.95	1034.95	41.5	50	7.82	4425	17.75	785437	429504	.547	.547	7.82	
33					1081	58.73	1139.73		54	7.23	4895		868862	472987	.542			
34					1184	60.51	1244.51		66	5.92	5475		971812	516471	.531			
35					1287	64.88	1351.88		73	5.35	6125		1087187	561030	.516			
36					1390	69.25	1459.25		78	5.01	6675		1184812	605588	.511			
37	4.09	6.02	7.31	1.00	1081	58.73	1139.73	41.5	45	8.69	4710	17.75	836025	472987	.561			
38					1184	60.51	1244.51		50	7.82	5125		909687	516471	.567	.567	7.82	
39					1287	64.88	1351.88		52	7.51	5600		994000	561030	.564			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE H.—PART III.

CHUTE No. 3.—*Centre buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum affect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
40	1.09	3.02	4.31	1.00	669	51.61	720.61	41.5	54	7.23	3600	14.75	531000	299053	.563			
41					772	53.39	825.39		63	6.20	4025		593687	342536	.576			
42					875	55.17	930.17		69	5.66	4450		656375	386020	.588	.588	5.66	
43					978	56.95	1034.95		77	5.07	4950		730125	429504	.588			
44					1081	58.73	1139.73		88	4.44	5500		811250	472987	.583			
45					1184	60.51	1244.51		92	4.24	6025		888678	516471	.581			
46	1.09	3.02	4.31	1.25	978	56.95	1034.95	41.5	44	8.88	4975	14.75	733812	429504	.585			
47					1081	58.73	1139.73		49	7.98	5435		801662	472987	.589			
48					1184	60.51	1244.51		52	7.51	5835		860662	516471	.600			
49					1287	64.88	1351.88		56	6.98	6275		925562	561030	.606			
50					1390	69.25	1459.25		62	6.30	6750		995625	605588	.607			
51					1493	73.62	1566.62		66	5.92	7250		1069375	650147	.608			
52					1596	77.99	1673.99		68	5.75	7625		1124687	694705	.617	.617	5.75	
53					1699	82.36	1781.36		71	5.50	8125		1198437	739263	.616			
54					1802	86.73	1888.73		80	4.88	8750		1290625	783822	.607			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE H.—PART IV.

CHUTE No. 3.—*Centre buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
55	1.09	3.02	4.31	1.50	1596	77.99	1673.99	41.5	64	6.10	7600	14.75	1121000	694705	.619			
56					1699	82.36	1781.36		66	5.92	8050		1187375	739263	.624			
57					1802	86.73	1888.73		69	5.66	8475		1250062	783822	.627	.627	5.66	
58					1905	91.10	1996.10		74	5.28	9025		1331187	828381	.622			
59					2008	95.47	2103.47		79	4.95	9725		1434437	872939	.608			
60	1.09	3.02	4.31	1.75	1699	82.36	1781.36	41.5	59	6.62	8030	14.75	1184425	739263	.624			
61					1802	86.73	1888.73		64	6.10	8460		1247850	783822	.628	.628	6.10	
62					1905	91.10	1996.10		67	5.83	9000		1327500	828381	.624			
63					2008	95.47	2103.47		72	5.43	9600		1416000	872939	.616			
64					2111	99.84	2210.84		77	5.07	10330		1523675	917498	.602			
65	4.09	6.02	7.31	1.00	1184	60.51	1244.51	41.5	44	8.88	4925	17.75	874187	516471	.590			Air vents open.
66					1287	44.88	1351.88		47	8.31	5300		940750	561030	.596			
67					1390	69.25	1459.25		51	7.66	5700		1011750	605588	.598	.598	7.66	
68					1493	73.62	1566.62		56	6.98	6160		1093400	650147	.594			
69					1596	77.99	1673.99		61	6.40	6625		1175937	694705	.590			
70					1802	86.73	1888.73		69	5.66	7650		1357875	783822	.577			
71					2008	95.47	2103.47		90	4.34	8650		1535375	872939	.568			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

(TO BE CONTINUED.)

Proposed plan for Smelting Iron Ore with Anthracite Coal.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The annexed communication was received from an unknown correspondent, and we have concluded to insert it in our journal, as it relates to a subject which we deem of the highest importance; we are not disposed to place much reliance, *a priori*, upon the value of his suggestions, as some of them are new and untried; but we are open to conviction as to their utility;—others we know to be erroneous. The writer has, we think, overrated the advantages of the water blast. That it produces a cheap and uniform blast is unquestionable, but the air which issues from it is so saturated with moisture as to occasion an increased expenditure of fuel, which more than counterbalances any advantages resulting from the cheapness and facility of construction, besides occasioning very serious inconveniencies in those furnaces in which the highest temperature is desirable. As to his suggestion of introducing a small jet of steam, we must be permitted to question its advantages; the experiment was tried many years since, in England, and failed. See Jour. Arts and Manuf. iv. 235, quoted in Hassenfratz's Siderotechnie, ii. 130. We invite the attention of our readers and correspondents to the importance of devising a mode of applying anthracite to the smelting of iron ore.

Com. Pub.

On the top of a reverberatory furnace, build a vertical furnace, with its lower extremity, or crucible, connected with the lower furnace, in such a manner that the hearth of the lower furnace shall serve for the hearth of the upper furnace also. The shape of the upper furnace may be similar to the common blast furnace, and its height about the same as the length of the lower furnace. The top of the upper furnace must not be open like the common blast furnace, but covered, and connected by a flue to the chimney of the lower furnace.

There must be an opening near the top of the upper furnace, for the introduction of the coal and ore, which must be kept closed, so that no air can enter, only through openings made for that purpose near the bottom of the furnace, in order to supply air for combustion. The flues of the furnaces must be connected and turned horizontally and inserted into a water blast, or *trompe*, (for the manner of constructing which, see Rees' Cyclopædia—article, water-bellows; and also in the Chemistry of the Arts, published by Porter, 1830, p. 57 and 58, there is an account given of its producing a very powerful draught of air through a furnace.) The reverberatory furnace must first be raised to a sufficient degree of heat; then the upper furnace charged with coal and ore: as the one melts it drops from the crucible of the upper furnace into the hearth of the lower furnace, where it will be kept fluid, until sufficient is collected to be drawn off. It is believed that a sufficient flame may be produced from anthracite coal to heat the reverberatory furnace, by introducing a small jet of steam, as has been done by the Messrs. Wetherells, of Philadelphia. If bituminous coal were used in the lower furnace, it would probably not affect the quality of the iron, as it would be always covered with fluid cinders.

The author of these suggestions melted iron ore very easily, in a small air furnace with anthracite coal, the only difficulty met with was, that the metal chilled on the hearth of the furnace. If, in this experiment, there had been means of keeping the melted metal fluid, the ore might have been smelted very fast, on a small scale, as there was no difficulty in keeping up a sufficient degree of heat to melt the ore in the furnace, above the *tuyere*, or opening, for the ingress of the air. The result of this experiment, and a knowledge of the fact, that a very powerful air draught may be obtained by the mode above referred to, (viz. the water-draught,) and a belief that a blast given by bellows is not so conducive to the rapid combustion of anthracite coal, as a more uniform and general blast, has induced me to make these suggestions to those who feel a sufficient interest to make experiments, in order to accomplish so important an object.

A. B.

Lebanon, Penn., August, 1831.

On Blasting Rocks. By ROBERT HARE, *M. D., Professor of Chemistry in the University of Pennsylvania.*

AN account has lately been published of the death of a workman, near Norristown, dreadfully bruised, and lacerated, by the blasting of a rock. I have ascertained that the process for blasting rocks may be rendered safer than the firing of a fowling piece, by a new application of galvanism. I was led to make this improvement in consequence of an application by a patentee, (Mr. Moses Shaw,) for assistance in perfecting his patented mode of blasting rocks by an electric discharge from a Leyden Jar.

In a letter dated June 1st, 1831, he says, "I have been engaged in blasting rocks by means of a fulminating powder, introduced into several cavities, and ignited in all of them simultaneously, by a spark from an electrical machine, by which means masses of a much larger size, and of a much more suitable shape, for any object in view, may be procured, than by the old plan. I have, however, to lament my inability to succeed in this method of blasting during a great part of the year, when, in consequence of the unfavourable state of the weather, the ignition cannot be effected by electricity in any mode which I have devised, or which has been suggested by others, although I have consulted all the best informed professors to whom I have had access."

It occurred to me as soon as this statement had been made by Mr. Shaw, that the ignition of gunpowder, for the purposes he had in view, might be effected by a galvanic discharge from a deflagrator, or calorimotor, in a mode which I have long used in my eudiometrical experiments to ignite explosive gaseous mixtures. This process is free from the uncertainty which is always more or less attendant upon the employment of mechanical electricity for similar purposes.

The expectation thus arising has since been fully verified. I have ignited as many as twelve charges of gunpowder at the distance of one hundred and thirty feet from the galvanic machine employed. This distance is much greater than is necessary to the safety of the operator, as the deflagrator may be shielded so as not to be injured by the explosion, and by means of levers and pulleys, it may be made to act at any distance which may be preferable. There is no limit to the number of charges which may be thus ignited, excepting those assigned, by economy, to the size of the apparatus employed.

These remarks have reference to the principal and highly important object of Mr. Shaw's project, which is, to ignite at once a great number of charges in as many perforations so drilled in a rock as to co-operate simultaneously in the same plan. By these means it is conceived that the stone may be separated into large prismatic or tabular masses, instead of being reduced to irregular fragments of an inferior size. The object to which I propose now to call attention more particularly is, a modification of the common process of blasting by one charge, which renders that process perfectly safe.

This part of the subject I shall introduce by premising that almost all the accidents which have taken place in blasting rocks, have occurred in one of the three following modes:

1st. The explosion has taken place prematurely, before the operator has had time to retire.

2nd. A premature explosion has ensued from a spark produced by the collision arising from ramming into the orifice of the perforation, containing the powder, the brickdust or sand employed to close it.

3d. The fire not reaching the charge after the expiration of a period unusually long, and the operator returning to ascertain the cause of the supposed failure, an explosion ensues when he is so near as to suffer by it, as in the instance near Norristown, lately published.

The means of communicating ignition, to which I have resorted, are as follows:—

Three iron wires, of which one is of the smallest size used for wire gauze, the others of the size, (No. 24,) used by bottlers, are firmly twisted together. This is best accomplished by attaching them to the centre of the mandril of a lathe, which is made to revolve while the other ends of the wires are held by a vice, so as to keep them in a proper state of tension. After being thus twisted, a small portion is untwisted, so as to get at, and divide, the larger wires by means of a pair of nippers. In this way the smaller wire is rendered the sole mean of metallic connexion between the larger ones. These are tied in a saw kerf, so made in a piece of dogwood as to secure them from working, which, if permitted, would cause the smaller wire to break apart. At one end, the twist formed of the wires is soldered to the bottom of a tin tube of a size to fill the perforation in the rock to such a height as may be deemed proper. This tube being supplied with gunpowder, the orifice is closed with a cork, perforated so that the twisted wire may pass out through it without touching the tube at any point above that where the finer portion alone intervenes. To the outside of the tube a copper wire, about No. 16, is soldered, long enough to extend to a copper, or leaden, rod proceeding from one of the poles of a galvanic deflagrator, or calorimotor. The wire passing through the cork, from the inside of the tube, is in like manner made to communicate with the other pole. The connexions between the wires, rods and poles, should be made by means of soft solder, previously to which we must imagine that the tube has been introduced into a perforation made for its reception in a rock to be blasted. The tin tube may be secured within the rock by the usual method of ramming in brickdust or sand, by means of a punch, having holes for the protection of the wires of communication already described.

The apparatus being thus prepared, by a galvanic discharge, produced by the movement of a lever through a quarter part of a circle, the finer wire is ignited, in the place where it intervenes solely in the circuit, so as to set fire to the surrounding gunpowder.

As the enclosure of the gunpowder in the tube must render it impossible that it should be affected by a spark elicited by ramming, as no means of ignition can have access to the charge besides the galvanic discharge; and as this can only occur by design, with an intention to commit murder or suicide, or from unpardonable neglect, it is inconceivable that an explosion can take place in this method of blasting, when any person is so situated as to suffer by it.

It must be obvious that in all cases of blasting under water, the plan of the tin tube, and ignition by a galvanic circuit must be very eligible.

I hope Mr. Shaw may meet with the patronage which his project merits.

Robt. Hare.

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

The committee appointed to investigate the causes of explosions in steam boilers have had the subject under consideration for some time; and have pursued with as much diligence as possible the course of experiments instituted with a view to shed light on this question. These experiments require much nicety and care; and the members of the committee are all so much occupied in their own private business that the inquiry is necessarily protracted. Some of the results which they have already obtained, they believe to be curious, and they will not fail in due time to lay them before the public. Their present intention is to communicate a portion of the letters which they have received. Although the replies to their circular have not been so numerous and detailed as they might wish, yet the committee have been favoured with many very interesting communications which they believe it would be an act of injustice to their authors longer to withhold from the public.

Independently of the general information which they are calculated to give, the circulation of these letters may be productive of other advantages. By publishing the opinions of able and intelligent observers, the committee hope to elicit a discussion of them by others. Such a discussion cannot fail to enlighten us still more on the numerous causes of the accidents which have occurred.

The committee, moreover, are under the impression that many acute and intelligent observers have been, from an excess of diffidence as to their talents for writing, induced to suppress their communications. Perhaps, after seeing the nature of the information required, they may feel disposed to contribute their share to the general stock. Facts, plainly and clearly stated, are the most valuable contribution which can be made; and there is scarcely a practical mechanic on our western waters who may not be able to communicate something that has escaped the attention of others. If any letters should come in a form not exactly fitted for publication, the committee would, with the permission of their authors, revise them with that view.

To avoid any appearance of partiality, the committee have determined to publish these letters in the order of their date, but they have been induced occasionally to deviate from this rule, so as to group together such as refer to the same accident. By exhibiting the views of different writers upon the same explosion, in one continued series, it will be easier to come at the truth as to its real cause. Thus, for example, in relation to the Helen M'Gregor and Caledonia, the committee will have the pleasure of presenting, in the next number, several letters which mutually confirm each other.

In order to collect all that bears upon that investigation, the committee are induced to commence their publication with the reprint of a very interesting pamphlet published many years since in this city, but which has now become very scarce. For the copy which is in their possession, the committee are under obligations to Roberts Vaux, Esq. the chairman of the committee of councils to whom this matter was at that time referred.

1. *Report of the Joint Committee appointed by the Select and Common Councils, on the subject of Steam Boats.*

The joint committee of the select and common councils appointed to consider "*whether any, and if any, what, regulations can be enforced in relation to the use of steam, employed in propelling boats for the accommodation of passengers, which arrive at, and depart from, the wharves within the jurisdiction of the corporation:*" and also, (should it be necessary,) "*to prepare a memorial to the legislature of the state, soliciting its interposition, effectually to control the use of steam in passage boats,*" Report:

That, sensible of the importance of the duty assigned them, they have devoted much time and attention to the investigation. They have availed themselves of the learning and experience of scientific characters, whose prompt, candid, and able illustrations and advice on the subject, are entitled to acknowledgments which the committee take pleasure in rendering for themselves, and on behalf of their constituents.

Convinced by the notorious and afflicting fact, that *human life* had been frequently destroyed in consequence of the bursting of the boilers of steam engines, used in navigating boats, it became a prominent and interesting question with the committee, *whether any, and what effectual mode could be adopted to prevent such explosion.* To the gentlemen previously alluded to, the inquiry was submitted. Their opinion of the necessity of legal interference, with a plan for testing the strength of boilers, and contemplating the attachment to them of safety valves, to be placed beyond the reach of the caprice or temerity of engineers, being furnished, it was with a circular note transmitted to the proprietors of those steam boats which pass upon the Delaware, and accompanies this report, numbered 1.

A disposition to acquiesce in the regulations and precautions, thus suggested, was manifested by the persons to whom they were proposed; but it was alleged by some of them, that their adoption would not provide against *all* the casualties incident to the management of steam engines which might produce explosion. It was represented, that the plan was calculated to give unjustifiable confidence to the public, that thereby the use of *high steam* would be sanctioned, when in fact, the most destructive consequences must inevitably be visited upon every person on board vessels propelled by it, should an accident from any cause whatever happen to a boiler, with which it was charged. And it was furthermore affirmed, that the fracture of boilers containing steam of the pressure ordinarily used in boats, could not subject passengers to injury, inasmuch as such occurrences had frequently taken place, producing no other inconvenience than delay to repair them.

With considerations of this nature the committee could not but be impressed, whether they regarded the responsibility fairly attachable to themselves, in recommending a course for councils to pursue, or anticipated the unhappy and afflicting consequences that might, in the range of probability, occur to those whose reliance for safety should be upon the entire security of the plan proposed.

A new train of reflection being thus excited, the committee were induced again to apply to the gentlemen who had previously aided them with their advice, from whom they solicited the favour of answers to the questions exhibited in the document numbered 2, herewith submitted.

The replies to those inquiries are contained in the communications numbered 3, 4, and 5—now furnished.

Much valuable and important information was derived from those letters, the nature of which has induced the committee to believe, that the use of steam employed in passage boats, is a subject so deeply and extensively interesting to society, as to render municipal enactments inadequate to a complete regulation of those establishments. To the higher authority of the state legislature, they would therefore earnestly recommend the subject, with a confidence, that its wisdom will devise, and its power enforce, such legal restraints as the object manifestly requires.

With this view, they respectfully submit the propriety of collecting further facts, to accompany a memorial to the Senate and House of Representatives of the commonwealth of Pennsylvania at its ensuing session.

ROBERTS VAUX,
WM. SMITH,
WILLIAM LEHMAN,
HOR. BINNEY,
GEO. VAUX.

Philadelphia, July 14, 1817.

(No. 1.)

(CIRCULAR.)

The unhappy consequences which have resulted from the explosion of the boilers of steam engines, employed in propelling boats for the accommodation of travellers, has excited serious and just apprehensions in the public mind, prejudicial to the interests of these valuable establishments, and requiring the interposition of such as are intrusted with the guardianship of the common welfare. Under impressions of this character, the select and common councils of the city of Philadelphia, appointed a joint committee to inquire what regulations ought to be enforced, in relation to the use of steam, so far as their authority might extend to vessels navigated by that agent, which arrive at, and depart from, the wharves, within the jurisdiction of the corporation. That committee anxious to learn from disinterested persons, of unquestionable scientific knowledge, what mode could be adopted to render the boilers of steam boats perfectly safe, addressed a letter to Professor Cooper, Joseph Cloud, Jacob Perkins, and Frederick Graff, in answer to which those gentlemen have furnished the opinions herewith exhibited. Previously, however, to the adoption of any measures, predicated upon this report, it was conceived to be most respectful to submit it to the proprietors of steam boats. I comply, therefore, with the directions of the committee, in transmitting this circular, with a request that on, or before, the 25th instant, information may be communicated, whether the plan proposed will be acceded to by those interested, or not.

Very respectfully,
ROBERTS VAUX,
Chairman of the Committee of Select and Common Councils
Philadelphia, 6 mo. (June) 12, 1817.

TO ROBERTS VAUX, Esq.
Chairman of a Joint Committee of the Select and common Councils of the city of Philadelphia.

The committee to whom was referred the question, "*whether any, and what effectual mode can be adopted, to render the boilers of steam* *engines employed in propelling boats, free from the danger of explosion,*" having met, and jointly considered the subject, are of opinion,

That, for the purpose of preserving the credit, and securing to the public the benefit of conveyance by means of steam boats, some regulations are absolutely necessary, and may be adopted without injury to the owners of vessels so navigated, whose interest ought to coincide in this respect with the interest of the public.

That two improvements are very desirable: if adopted, would prove sufficient to ensure the safety of the passengers from the dreadful accidents which have lately taken place, by the bursting of boilers, and the explosion of steam strongly heated: these are,

First, to adopt and enforce the following regulations, viz. allowing every captain or owner to navigate his vessel with steam raised to whatever temperature he thinks most expedient for his own purposes, he should be compelled to permit inspectors, appointed by law, once in every month, to prove the strength of his boilers, by loading them for the purpose of ascertaining their strength; first, with double, and afterwards with once and a half the force of the steam he proposes permanently to use, by filling them with water, and loading a pipe with the weight necessary to give to the boiler the required pressure. This can be conveniently managed by pressure on Bramah's principle, and need not occupy an hour's time. Thus, if the captain proposes to work with steam pressing with a force of ten pounds on the square inch, let the boiler be tried with a pressure of twenty pounds on the square inch; and then with a force of fifteen pounds per square inch. If it stands this trial, it may reasonably be presumed to bear the required pressure of ten pounds per square inch, until the next monthly period of trial appointed by law. To make it sure that the engine shall not be worked in any intermediate time, by means of steam affording a higher pressure than that required, let a separate safety valve be provided, and kept locked up in a box connected with the steam engine apparatus, of which box the inspector appointed by law ought to be permitted and required to keep the key, which box should not be opened till the next period of inspection. This safety valve should be regulated to the pressure required, and at which the steam engine is to be actually worked. So that however high the common exposed safety valve may be loaded by those who work the engine, the safety valve, locked up, shall effectually prevent the use of any higher pressure than that permitted.

A *second* improvement would be, to separate the steam engine apparatus by strong partitions erected between this and the part of the vessel occupied by the passengers: which partitions should be so constructed as to be decidedly the strongest part exposed to explosion, should such an event take place. Hence the planking of the sides of the vessel near to the steam engine apparatus, and the part of the deck that covers it, should be purposely made somewhat weaker than the partitions, and more liable to be torn or blown away by an explosion, which in such case could not affect the passengers.

The committee beg leave to observe, that such trials of the strength of boilers are on the same principle with the acknowledged necessity of trying the strength and resistance of all kinds of fire arms: and that the periodical repetition of these trials is made necessary by the unavoidable wear and tear of the machinery to which a steam engine is exposed.

The second improvement is suggested from the common practice of gunpowder makers, who are also liable to dangerous explosions, and who make those sides of their rooms weak, where an explosion can do the least damage when forced by the strength of the other sides to take that direction.

The committee further observe, that the boilers of the steam engine should be made of sheet and not of cast iron, which in case of explosion is much more dangerous from its fragments than sheet iron. But if the improvements now suggested by the committee should be adopted, it is hardly possible for an explosion to happen at all, or, if it should happen, to prove dangerous in any degree to the passengers in the vessel.

Those owners of steam boats who are willing to submit to the proposed regulations, ought to be strongly recommended to the public in preference to others: but the sense of safety that a passenger will feel in consequence of these improvements being adopted, will be of itself a sufficient recommendation of those boats wherein they are adopted. All which is respectfully submitted.

THOMAS COOPER,
JOSEPH CLOUD,
JACOB PERKINS,
FREDERICK GRAFF.

Philadelphia, June 11, 1817.

(No. 2.)

Thomas Cooper, Joseph Cloud, Jacob Perkins, and Frederick Graff, Esquires.

I am directed by the joint committee of the select and common councils of the city of Philadelphia, appointed on the subject of steam boats, to submit the following questions for your consideration, and request the favour of answers, as early as they can be furnished, consistently with your convenience.

Very respectfully,
ROBERTS VAUX,
Chairman, &c. &c.

Philadelphia, 7 mo. (*July*) 3, 1817.

First. Whether what is commonly called a high pressure engine is, in your opinion, proper for a passage boat; whether, with the precaution of proving the boiler once a month, and a double safety valve, as proposed by you, will render them perfectly safe; and whether, in case of an explosion when the steam is at the ordinary pressure at which such engines are worked, it would not probably be fatal to the life of most of the persons on board.

Second. Whether an engine that works with a pressure of from seven to ten pounds to the square inch, would, in case of explosion, probably do any injury, except to persons who were immediately adjacent to the boiler, or who were not separated from it by a partition; and whether the common partition in use in boats navigated by low pressure, and the distance at which passengers on deck or in the cabin are from it do not make them safe?

Third. Whether, to your knowledge, boilers on the low pressure plan have not frequently burst without any injury whatever to the passengers; and if any case to the contrary exists, what are the particulars of it? What experience have you on the subject of explosions of high pressure engines, and the consequences?

(No. 3.)

To Roberts Vaux, Esq.
Chairman of a Joint Committee of the Select and Common Councils of the city of Philadelphia.

Sir,—In reply to the further questions proposed by the committee, the undersigned states as his opinion,

1. That whatever be the construction of a steam engine on board a boat, the precautions already recommended in a former report to the committee, are *indispensable* to the perfect safety of the passengers.

2. Although, with due precaution and continual care, the danger arising from engines working with high pressure, may be reduced so as to render them as little liable to explosion as the engines that work with a low pressure, yet accidents must be calculated upon to happen to engines of all and every construction, at one time or other. In such cases, the danger will be far greater from engines worked with steam of high pressure, than with the common engines of Boulton and Watt, or of Fulton. Even in cases where the danger arising from an accident is trifling, the noise, and the vapour that issues from a very small opening in the boiler, or other parts of a high pressure engine, are so much more alarming to persons ignorant of the cause, than when a similar accident happens in an engine of low pressure, that the chance of this happening well deserves to be taken into the account; for the fright and the alarm may have serious consequences, even when there is no real danger.

3. Every engine working with steam beyond ten pounds upon the square inch, ought to be considered as a high pressure engine.

4. Under present circumstances, it seems expedient to give a decided preference to engines in steam boats, where the pressure is below ten pounds on the square inch; for even that pressure is unnecessary, and may, and ought to, be avoided.

5. With respect to the explosions and accidents that have happened on board steam boats, in this country and in England, the statements have been too loose and general, to afford any foundation for an accurate and decided opinion, but enough has been published, to show that these accidents have happened from rashness or negligence,

by means of which, the steam valve has been overloaded, or by using machinery ill made, or too much worn. A steam engine on the construction of Boulton and Watt, may rashly or negligently be loaded with fifty pounds instead of five pounds; but it is manifest, that steam pressed with twenty pounds for instance, cannot possibly do so much damage as steam pressed with two hundred pounds on the square inch. In the latter case it would act nearly with the force of gunpowder, as there is good reason to believe it has often done.

6. As in all civilized countries passengers are under the protection of the law, and ferries and carriers, whether by land or water, are objects of legislative control, this subject seems to the undersigned proper to be submitted to the consideration of the legislature.

THOMAS COOPER.

July 7, 1817.

(No. 4.)

SIR,—In answer to your inquiries, respecting high pressure engines, and those on the Boulton and Watt principle, with steam from seven to ten pounds on board of passage boats, I submit my opinion, without any other motive than that for the safety of the lives of those who travel by that convenient mode.

1st. As respects high pressure engines, I am of opinion, that if the precautions recommended in a former report are rigidly enforced, perhaps explosions would not take place; but presuming that, with all the care of those appointed to make a monthly survey, some part of the work might be overlooked from hurrying the examination, in order to have the boat ready for the succeeding trip; this induces me to believe that it is probable fatal accidents may occur, and many lives be lost, if an explosion should take place.

2nd. An engine that is worked with a pressure of from seven to ten pounds to the square inch, with a boiler reasonably strong, there can be little danger of explosion; but should an explosion take place, I am well persuaded that the danger to passengers in the cabin, or on deck, would be trifling, provided the partitions and deck between the boiler and the cabin are sufficiently strengthened, *and the doors, if admitted at all*, are hung in such way that by the concussion occasioned by the explosion, they would fly shut; I would recommend an additional passage from the cabin to the deck in the after part of each boat, that in case of accidents a more ready passage would be at hand, without being obliged to pass out near the boiler, as is now the case in most of the steam boats on the Delaware.

3d. The only burst which has come to my knowledge in working low pressure steam, happened with one of the boilers at the lower engine of the Philadelphia water works, occasioned by the heads of the bolts burning off over the fire place, and the joints parting; the workmen received no injury, as the fire doors were shut, the boiling water passed into the ash pit.

From all the information I have obtained, it appears, that every accident that has occurred was occasioned by high pressure steam, applied either in engines adapted for working high steam, or those of Boulton and Watt, which were never intended by the inventors to carry more than six pounds on the extreme. As the Boulton and Watt engines are now worked, with from ten to twenty pounds pressure, I conceive the danger of explosion nearly as great, as with those working at a pressure of one hundred and fifty pounds to the square inch, and in some instances greater, where the construction of the boilers is not adapted to carry more than from seven to ten pounds with safety.

I am not sufficiently acquainted with the injuries that have taken place by the explosions of boilers in working high steam, to give any correct information on that subject.

In order to prove my assertion in favour of working low pressure steam on board passage boats, I submit calculations of the dead pressure acting on each sort of boilers when ready to put an engine in motion.

The dimensions of boilers most approved of for high steam, are cylinders of wrought iron, generally twenty feet long, and two feet six inches in diameter, which, calculated at 150 pounds to the inch, is on the whole superficial surface 3,595,800 pounds, or on each inch in width of the circumference 14,100 pounds, or on the superficial foot 21,600 pounds.

A boiler for a Boulton and Watt engine, built on the same plan, with the same materials; twenty feet long and seven feet diameter, calculated at ten pounds pressure to the inch, is on the superficial surface, 742,020 pounds, or on the circumference 2,630 pounds, or on the superficial foot 1,440 pounds.

From these data, it is obvious that the latter principle must be the safest.

I am, with great respect,
Your obedient humble servant,
FRED. GRAFF.

Philadelphia, July 9, 1817.
ROBERTS VAUX, Esq.
Chairman of the Select Committee of Councils on the subject of Steam Boats.

(No. 5.)

Philadelphia, 8*th July,* 1817.

SIR,—In reply to the further questions proposed by the committee, the undersigned is of opinion,

1st. That all engines, worked with a pressure above from five to seven pounds the square inch are unsafe, unless the precautions already recommended in a former report to the committee are adopted. That engines which work with a pressure of seven pounds and below, need only a second safety valve, without the proof; for, should an explosion take place, experience shows that the passengers would be perfectly safe. There is no doubt, that in case of an explosion, the higher the steam the greater the danger; but engines may be so constructed, that there would be no danger, even with a pressure of 150 pounds to the inch. Boilers may be made to withstand the pressure of 600 pounds to the inch, and if proved often enough to detect any defect occasioned by corrosion, or otherwise, it would seem that no explosion could possibly take place.

2nd. If boilers were made so weak as to be *sure* of bursting at a pressure of seven pounds, or below, there would be but little or no danger from such explosions; but boilers have many modifications; some will burst at the low pressure of four pounds, when others will not burst at 300 pounds. The boilers that are constructed to bear the pressure of twenty to fifty, or sixty pounds, the undersigned is of opinion, are the most dangerous, since it is more easy to get the steam up to that height, than to raise it to from 150 to 300 pounds.

3d. As far as the knowledge of the undersigned extends, all explosions that have taken place, where the engines have been worked at seven pounds and below, have done no injury to the passengers. It is the boilers that have been made to bear a higher pressure than seven pounds to the inch, which have proved so fatal; but had the owners known their strength, and been provided with safety valves properly adjusted, no explosions would have taken place, unless they had been constructed like the two on the Mississippi, which have produced such disastrous consequences. This form of boilers should certainly be abandoned; no safety valve, nor any precaution, would make them secure. These boilers are cylindrical, and have flues passing through their centres. The misfortune has not happened by the bursting of the boilers, but has been occasioned by the flue, where the fire is built, being heated to such a degree, when the water has been suffered to get too low, so as to collapse and make an opening for the steam and water to rush out. This was the case with the Washington and Constitution. At the Pittsburg nail factory, where Evans's most improved boilers had been used for a number of years,* it was apprehended that it was time to replace them, and while new boilers were making, one exploded when the steam was at sixty pounds. When examined, it was found that a piece was blown out at the top, about four by six inches. It removed a few bricks, but occasioned no mischief. It was found that the thickness of the iron was reduced by corrosion to less than one sixteenth† of an inch, at the spot where the explosion took place. The undersigned has not been informed particularly, as to the other disastrous explosions, but he believes several have taken place at as low as twelve or fifteen pounds pressure, and that such ought to be considered as high pressure engines.

Yours, respectfully,
JACOB PERKINS.

ROBERTS VAUX, Esq.
Chairman of the Select Committee of Councils on the subject of Steam Boats.

---

* This rapid corrosion was occasioned by the use of mineral water: since river water has been used no such event has taken place.

† When new it was five sixteenths.

On the Structure and Management of Steam Engine Boilers. By Col. S. H. Long, *U. S. Engineer Corps.*

TO THE COMMITTEE OF THE FRANKLIN INSTITUTE.

Philadelphia, July 9, 1830.

Gentlemen,—At your request, I have the pleasure to submit a few hasty remarks in reference to defects in the construction and management of the boilers of high pressure steam engines, and to the accidents liable to result therefrom, to which I shall take the liberty to add a few observations on the means of preventing their explosion.

The Western Engineer, which was constructed under my immediate direction, and in which the exploring expedition under my command travelled from Pittsburg to the Council Bluffs, in 1818, had three cylindrical boilers, about 15 feet long, and 20 inches in diameter, the iron of which they were made being $\frac{3}{16}$ inch thick. The position of the boilers was horizontal, and their direction parallel to each other, and to the sides of the boat. The fire places were located at the front, and immediately beneath the two exterior boilers. The flues extended backward from the fire places quite to the aft end of the boilers, where they united under the centre boiler, and were returned through a single flue, to the front, and thence ascended through the deck of the boat, passing upward in a chimney about 19 feet high.

The ordinary working pressure of the steam, was 96 pounds to the square inch, as indicated at the safety valve. On some occasions, the pressure was raised to 128 pounds per square inch.

No precautions were taken to cleanse the boilers of the mud taken in from the turbid waters of the Mississippi, till we had ascended about 170 miles in that river; when, in consequence of the difficulty of generating a sufficiency of steam, it was thought best to examine and cleanse the boilers. On removing their caps we discovered that a large quantity of mud had been collected, which was not equally distributed in the boilers, but appeared to have been accumulated in greatest abundance, at those parts of the boilers which had been subjected to the greatest heat, while other parts were comparatively exempt. For example, those parts of the exterior boilers, immediately above the bridge at the backs of the fire places, and especially that portion of the centre boiler immediately above the junction of the two exterior flues, were incrusted with mud to a very considerable thickness. The mud, or rather crust, on the portion last mentioned, was at least two inches thick, and, on further examination, it was found that this portion of the boiler had been enlarged, or *blown out*, (*bladder-like,*) till the apex, or extreme surface, of the enlargement had receded from the original cylindrical surface of the boiler about 1½ inches. An explosion was no doubt prevented in this case by the cracking of the mud crust, and the admission of water through the cracks, the former being occasioned by the enlargement of the interior surface of the boiler at that place, and the latter serving to cool the enlarged side of the boiler before an explosion could take place.

It has frequently been observed, in reference to the steam boilers employed in the western country, and especially to those in which steam is generated by the heat of an intense coal fire, that those parts of the boiler exposed to the greatest heat, soon became oxidized, and reduced in thickness by exfoliations. This is probably to be accounted for on the supposition that in consequence of the rapid production of steam, a very thin atmosphere of it is formed on the interior surface of the boiler, at such points as are exposed to intense heat, and prevents the water from coming into immediate contact with the boiler.

In the spring of 1820, I embarked at Pittsburg on board of the steam boat Telegraph for St. Louis. The boat was entirely new; had her cabin above the main deck; her boilers in the bow; and her engine and paddle wheels at the stern. The supply or force pump, was, of course, connected with the engine, and the water had to be conveyed to the boilers through a distance of at least 60 feet. The supply pipe was of wrought iron; it ascended from the engine to the upper deck, passed along the upper deck to the aft end of the boilers, descended to, and entered, a horizontal pipe situated midway from the top to the bottom of the boilers, and communicating with them respectively at or near their centres.

Among a variety of accidents that occurred on board of this boat, was the following, which is to be regarded as having a particular reference to the subject before us.

We had not proceeded many days on the voyage, when all on board were alarmed at a sudden and apparently unaccountable cracking and knocking in the supply tube, attended with shocks in that member of the machinery, which produced copious jets throughout its whole extent. This accident was no doubt occasioned by a scarcity of water in the boilers, by reason of which the *debouchures* of the supply tube were left uncovered with the water, and the steam from the boilers gained admission into the supply tube, and on coming in contact with the cold water of the tube instantly condensed.

The surest and safest mode of applying the supply tube to cylindrical boilers, is that effected by means of a horizontal tube, situated transversely of the boilers, a little back of the fire place, and beneath the apron of the aft part of the furnace, from which tube branches lead upward and communicate, through the furnace, with the lower part of each boiler. This tube has sometimes been accidentally stopped, and the passage of the water to one or other of the boilers has been thereby prevented. In order to avoid accidents from a cause like this, especial care should be taken to have the tube large, and free from obstructions of every kind, and especially from nails, &c. which are often used in the construction of *cores* for casting, and are sometimes inadvertently left in the tube.

A piece of timber in contact with, and resting upon, the tops or upper parts of a set of cylindrical boilers, has been known to take fire from heat communicated through the boilers, (probably while the steam engine was in operation,) although the ignited timber was considerably remote from any fire flue. This occurrence was no doubt owing to the transmission of heat through the steam contained in the boiler, resulting from a scarcity of water in the boilers, by reason of which certain portions of them exposed to a strong heat, were not covered with water.

The mode of constructing furnaces for cylindrical boilers, (in the western country,) is such that the heat is communicated to the outsides of the boilers, to the height of about three inches above a horizontal line passing through their centres. Moreover, the longitudinal fire flues usually introduced into the boilers are so situated that their upper sides rise at least to the same elevation, and sometimes higher. Hence, unless the water of the boilers rises to a height somewhat greater than either of those above adverted to, the accident above mentioned, and even others of a more fatal aspect are liable to take place.

These considerations afford a double clue to the prevention of accidents of this nature, viz. 1st. the necessity of a sure test for determining and maintaining the proper quantity of water in the boilers, and, 2nd. of a test by which any difference between the temperature of the water in the boilers and the steam above it, may be detected.

It is true that an increased temperature in the steam above that of the water is serviceable, in preventing the condensation of the former in its passage from the hotter to the cooler parts of the machinery, in which last it must necessarily perform its functions; nor is it deemed impracticable to effect this valuable purpose by suitable apparatus. Yet, in the present structure of the steam engine, safety would be more promoted by maintaining a uniform temperature, both in the water and the steam contained in the boilers.

I shall conclude with a few speculations, suggested in the course of my limited experience and observations, in reference to steam boilers. The remarks I have to offer under this head, are grounded upon certain properties of materials, which I am inclined to *think* have not been sufficiently consulted in the construction and use of machinery generally, and of steam boilers in particular.

It is a pretty well established fact, that the continuity, tenacity, or strength of materials, is constantly impaired by every force exerted upon them, and by every action they perform, whether continuous or intermitted. For example, a rope or cord continually strained, gradually parts with its tenacity. A spring continually, or occasionally, bent, loses its elasticity. A bell, after having been rung steadily for a long succession of years, will break. The trunnion of a field piece may be broken off by repeated strokes of a hammer or sledge; the number of strokes required for this purpose being in some due proportion to their intensity, and the weight of the hammer. In fine, I have no doubt that all materials, (inasmuch as none are *perfectly* elastic,) are subject to this law.

The inference to be drawn in relation to steam boilers is, that their strength is constantly impaired by the strain exerted upon them, and that, in consequence, they ought to be more frequently tested or proved, in order to determine their ability to resist the pressures to which they are subjected. It is believed that, in most instances, boilers have never been tested beyond their ordinary working capacities; and that whenever they have been proved, a single trial has been deemed sufficient for the entire duration of the boiler.

In order to obviate the danger attendant on experiments of this sort, and to render the trial as economical, easy, and expeditious as the nature of the case will admit, I would suggest the following method. 1st. Let experiments be carefully instituted and made, for the purpose of determining the tenacity of the different kinds of iron, &c. employed for the construction of boilers, at all the varieties of temperature to which they are subjected in the *raising* and *working off* of the steam. From these experiments let a table be formed showing the diminution of strength for every degree, or 10 degrees of increased temperature, and especially for all temperatures above the boiling point.

2nd. Let a weight be attached to the lever of the safety valve, sufficient to produce a pressure upon the valve, at least one-fourth greater than that imparted by the highest steam ever intended to be used in the boilers; due allowance being made for the reduction of tenacity occasioned by the degree of temperature corresponding to the steam pressure required, which temperature may be determined by a recurrence to Dalton's tables, showing the temperatures corresponding to different densities of steam.

3d. Let the force pump be adjusted in such a manner as to be worked by hand, (by means of a handle or brake adapted to that purpose,) with a view to communicate by manual exertion the pressure requisite to raise the safety valve.

4th. Let the boilers be filled with cold water, the safety valve be closed, and the force pump worked vigorously, till a force is communicated sufficient to raise the safety valve, and the strength of the boiler will have been sufficiently tested. The trial, and proof, may be made as often as occasion may seem to require, and the boilers effectually proved, in half an hour, without serious inconvenience.

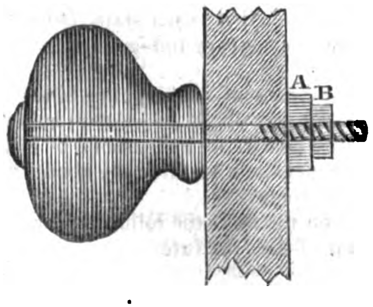
Having no leisure to revise and copy, I must crave your indulgent acceptance of the foregoing rough minutes.

I am, very respectfully,
Your most ob't.
S. H. Long.

Secure Fastening for Drawer Knobs.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—I have been often plagued in my furniture by the glass knobs, now so much used, becoming loose; and I find that no successful expedient has hitherto been adopted to remedy this annoyance. After several fruitless efforts, I have at last hit upon a plan, which I have found to be completely effectual, and at the same time, it is very simple. The annexed cut being a section of the knob and spindle, will represent the contrivance.



A, is the ordinary nut. B, an extra nut, which I form octangular, or hexagonal, to make a better finish. Putting on the knob and spindle, as usual, I screw up the nut A, until the knob has the degree of tightness at which I wish it to remain. Placing then a key, made of a plate of brass or iron, on A, to keep it from turning, I screw B strongly against it; and I find that on turning round the knob and spindle they carry with them both the nuts, if properly put on. The reverse of this, in ordinary cases, is the cause of the knobs becoming loose.

The use of two nuts clamping each other, is familiar to all persons conversant with machinery; all the merit I claim, is that of applying this well known contrivance to the remedying a domestic annoyance, which, from its frequent occurrence, may be termed a serious evil. W. H.

Baltimore, September 15th, 1831.

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Franklin Institute, was held at their Hall, on Thursday evening, August 25th, 1831.

Thomas Fletcher, Vice President, in the chair.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute.

By Messrs. Carey and Lea.

The Family Dyer and Scourer, being a Complete Treatise on the art of Dying and Scouring.

By Mr. Reuben S. Gilbert.

The Cabinet of Natural History and American Rural Sports, No. 8, for August.

By Mr. W. C. Redfield.

Remarks on the prevailing Storms of the Atlantic Coast of the North American States, by the donor.

A letter from Hardman Phillips, Esq., of Phillipsburg, Pa., was read, accompanying the following specimens, viz:—

Coke made by the process of distillation.

Coke made in the open air; and

Iron in the various stages of its manufacture, from the ore to the completion of screws.

Mr. Phillips says, "my principal object in submitting these specimens to public inspection is, to invite the manufacturers of Philadelphia, to the study of the resources of their own state, (so well calculated, if duly fostered, to render the country independent of foreign supplies.")

He also states, "that after the process of making the blooms, which is done at the forge, the principal part of the subsequent manufacture is performed by boys from the charitable institutions of Philadelphia. Neither is there a single mechanic at this time about the works who has not learnt his trade at them."

The corresponding secretary laid on the table the following works received in exchange for the Journal of the Institute.

Recueil Industriel, for March.

Bibliothéque Physico-economique, for May.

Annales de Chimie et de Physique, for February.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for January and February.

The Ladies' Book, for August.

Southern Agriculturist, for August.

The Illinois Monthly Magazine, for July.

Mr. Keating stated that the Horticultural Society of this city had issued a circular asking for information relative to the cultivation, consumption, &c. of dyer's madder, barilla, and woad, which has been republished in the Journal of the Institute—whereupon, this subject was selected for discussion at the next meeting of the Institute.

THOMAS FLETCHER, *Vice President.*

J. HENRY BULKLEY, *Rec. Sec.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1831.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in the *Mill for grinding Grain;* John Ambler, Jr., and Daniel C. Ambler, New Berlin, Chenango county, New York, June 13.

The Messrs. Ambler obtained a patent on the 6th of Dec. last, for an improved portable grist mill, the runner of which was to be kept down by means of heavy weights; the present patent is taken for some further improvements which have been suggested by experience. The mode of hanging, balancing, and driving the stone has undergone some alteration; but the principal point appears to be the substituting of a spring for the weighing formerly employed to keep the running stone down. To a beam above the stone "is attached a spring so placed that it acts on the steel point, and holds it firmly in contact with the safety rod,—which prevents the upper stone, or runner, from rising when the feed is fast. In case any large articles pass between the stones, this spring yields, and allows the stone to raise sufficiently to let the article pass between them." "The eye of the runner is to be made larger near its face than it is above."

"The parts to which we lay claim as original are the manner in which the upper stone is prevented from rising when grinding fast, by means of a spring, and the arrangement of the parts as specified; also the making the eye of the runner larger near its face than it is above; and the manner in which the upper stone is balanced and driven."

2. For improved modes of *drawing off two separate liquids, which, by their union, produce an effervescing beverage;* John Ambler, Jr., New Berlin, Chenango county, New York, June 13.

This patent is taken for an apparatus similar in its object to that described at p. 176, patented to Justice Perkins, May 3.

---

3. For a *Carriage to run on Rail-ways;* William Bryant, and Isaac Keit, Davidson county, Tennessee, June 13.

This carriage is intended to run upon a single rail, in a manner resembling that of Palmer's, patented in England. The carriage is suspended so as to hang below the rail upon which the wheel runs. From the frame by which gudgeons of the main wheel are sustained, an arm projects, upon which there are wheels, or friction rollers, which acting upon the top, and on each side of the rail, serves to guide the carriage, and renders it unnecessary to use flanches.

The whole apparatus is described and figured without any part being designated as new, although it is manifest that the principle has no claim to novelty. The particular arrangement of the parts described, differs sufficiently from that adopted by Palmer to have admitted of a specific claim.

Notwithstanding the apparent simplicity of the *single rail*, its employment involves a complexity in the adaptation of the carriage, and in other particulars which appear to be objectionable. We believe that Palmer's rail and carriage have been used for the purpose of experiment only; at all events, we have never heard of any thing further respecting them, although they were patented three or four years ago. To sustain a rail at the height required by this plan, with that degree of stability which is necessary, offers such practical difficulties as are very likely to prevent its adoption.

---

4. For a machine for *Shelling Corn and Cleaning Grain;* Ezra Bond, Mendon, Monroe county, New York, June 13.

The patentee tells us that "the said machine consists of a cylinder and curve, with iron spikes in each. Also wire screens, and wooden wings for winnowing grain; and a revolving apron to conduct the grain into the machine. The said curve springs agreeable to the quantity of corn or grain between the spikes of the curve and cylinder, all of which move by turning of a crank; and for a more full description, a drawing is herewith annexed, to which reference may be had, and which forms part of this specification."

It will be seen that a number of old acquaintances are congregated together in the foregoing description, and upon examining the different features they all appeared perfectly familiar. We, however, shall imitate the patentee, and not make any claim to them, as they make no part of our own offspring.

---

5. For an improvement on the *Mechanical Fan,* patented on the 27th November, 1830; Jas. Barron, Esq., Navy Yard, Philadelphia, June 13.

In the former specification, the fan was made to vibrate, like a pendulum, by means of a weight acting upon wheel work. The improvement now claimed is the "giving motion to the fans, &c., by means of two pulleys, and a connecting band, producing a rotary, instead of the crank vibratory, motion, formerly used."

A suitable frame is made to sustain moveable pulleys, and a weight which is wound up like the weight of a jack. Arms project from the top of the frame, and from these descends a rod, at the bottom of which there is a "cross bar, or stick, on which are placed the fans and shreds, or threads, for creating a breeze, and driving away the flies and moschettos."

This plan is much more simple than that originally patented, and noticed in vol. 7. p. 170. For a machine to keep off flies, we have employed an apparatus intended for another purpose, which is no larger than a quart mug, and one that may be frequently found for sale at our stores; we allude to the spring roasting jack, which is wound up like a clock, and will run for an hour or more. The fanning, or fly driving apparatus occupies the place of the meat, and instead of roasting the dead animal, the living one is cooled, and protected from the flies.

---

6. For a *Complete Churner;* Cyrus Baker, Charlton, Saratoga county, New York, June 13.

This is the common dasher churn, but it is to be worked by machinery. A frame is made, across the upper part of which there is a shaft with a crank at its centre; a pitman, or shackle bar, descends from this shaft to the dasher of the churn. A large cog wheel is to be turned by a hand crank, and this takes into a pinion on the crank shaft, which works the dasher up and down.

Four pages of description introduce us to a knowledge of the structure of the foregoing machine, which, after all, has about as much claim to novelty as it has to simplicity.

The claims are to the use of the cog wheel, to the way in which the holes are slanted for the play of the handle, &c.

---

7. For an improvement in the *Machinery for Spinning Cotton, &c.;* John Brown, Stonington, New London county, Connecticut, June 13.

Those who are acquainted with Thorp's ring groove spinner, and with the various modifications of that invention, which have been described in this journal, will perceive that the improvement claimed by Mr. Brown consists of another variation in the mode of applying the same principle.

"The ring is made of steel or iron, turned true, having a groove on each side near the inner edge. In this ring is a sliding piece let in about half way the thickness of the ring, to admit the travellers for guiding the thread. The travellers are small pieces of hardened steel, bent in a circular form,—open at one side. They move in the grooves in the rings, and guide the threads."

The claim is to the "making the ring in two parts, so as to admit the travellers;—hardening the travellers; making also a double ring with a groove between them to admit the traveller to run in it. Likewise the mode of giving the machine an accelerated motion."

---

8. For a machine called a *Self-balanced Hand Cart;* George Coolidge, Watertown, Middlesex county, Massachusetts, June 13.

This is a kind of hand cart, or barrow, for removing earth in excavating for canals, and other purposes. The body is made with the sides sloping, and is suspended upon two wheels, 4 feet 6 inches in diameter, by means of gudgeons, or axles, which are attached to the body near its upper edge. There are shafts, or handles, which are formed by the elongation of the top timbers of the frame of the cart, and a leg extending down from each shaft, like the legs of a wheel barrow. The bottom of the cart is made to fall, being made in two parts, which are hinged to the front and back of the frame, like two shutters. From these shutters, rise chains, which hitch on to a pin on the side of the cart, when the shutters are closed. A lever, which passes out alongside one of the shafts, acts upon the chains, and lowers or raises the bottom.

The use of the legs is to support the weight of the shafts, and the action of the lever; as, were these removed, the body would still remain suspended, the principal part of it, and its whole load, being below the point of suspension. The whole of the body lies within the circumference of the wheels, its length not being equal to their diameter. The earth is, in general, to be dropped by letting down the bottom, but when it is moist and adhesive, the body is to be inverted by raising the shafts, and turning them completely over.

The wheels are, of course, to run upon planks laid down for the purpose. Each cart is to contain 11 or 12 cubic feet of earth, and a number of them may be linked together, and drawn by horses.

There is no claim made, and perhaps the general plan is sufficiently novel and distinctive without particularizing the parts. There is, however, one effort at exactness which, were specifications to be construed rigorously, would endanger many a patent; namely, the precise dimensions of all the parts. We are told, for example, that "the wheels are 4½ feet high; spokes 1¾ wide, and 1¼ thick; felloes 2½ inches wide, 1½ inches deep; tire 2½ inches wide, and ¼ inch thick." And so of all the other parts.

---

9. For a machine for *Chopping Meat, Pulverizing Spices, Hommony, &c.;* Benton P. Coston, city of Philadelphia, June 13.

A round wooden block is to have its upper end excavated in the form of an inverted cone; a cylinder of tin, or other metal, is to extend up from this excavation to form the sides of the mortar. A chopping knife, with two edges, adapted to the cone, is to be fixed on to one end of a handle, or shaft, and at its other end there is fixed an iron pestle. The shaft is to slide in guides, keeping the knife or pestle in the centre of the cone, and one end, or the other, is to be turned downwards, according to the kind of work to be performed.

There is no claim made, the whole, wooden mortar and all, being, of course, considered as a new *invention.*

10. For *Propelling Machinery, and driving the Stones in Grist and Flour Mills;* Jeremiah Case, Sodus, Wayne county, New York, June 13.

This is for a reacting wheel, and we are told that "the improvement is in the application of the reacting wheel to the shaft to which the stones are attached, without gearing; by which greater velocity is gained with equal power, than by any other method now in operation, rendering the use of gearing unnecessary." "The reacting wheel, which is three feet diameter, is placed on the lower end of the shaft, in a horizontal position, and at the foot of the shaft is inserted a concave iron box, resting on a pivot of hemlock knot, or other hard wood, placed upright in the bridge tree." These are the main points of the description, after which the patentee adds, "I further claim as my invention, an improvement on the reacting wheel, in the construction of the buckets which allow an equal space through them for the discharge of the water; avoiding the inconvenience to which these wheels have hitherto been subject by being made wedging, and thereby retarding the motion. I also claim as my improvement, the use of the wooden pivot, and the mode of applying it to the concave iron box, as mentioned in my description."

The drawing is a very poor affair, but there is a sketch of the wheel intended to be used, which appears to be that invented by Calvin Wing, and described in the specification of a patent obtained by him, inserted p. 87 of our last volume.

ENGLISH PATENTS.

To THOMAS COBB, *Esq. for his invention of certain improvements in the manufacture of paper, intended to be applied to the covering of walls or the hanging of rooms, and in the apparatus for effecting the same. Sealed* 15*th September,* 1829.

THE invention for which this patent is granted, is a mode of producing an embossed surface of papers intended for covering walls of rooms, by which a beautiful effect can be produced on papers which are coloured in the pulp, and not stained after the paper is made, as is usual with paper hangings; and by which also, silks, velvets, or other coloured goods can be put upon the surface of paper, and when embossed will produce a rich and beautiful appearance.

SPECIFICATION.

"My improvements in the manufacture of paper, intended to be applied to the covering of walls or hanging of rooms, and in the apparatus for effecting the same, consist, first, in manufacturing tinted or coloured paper intended to be applied to the covering walls or hanging rooms, by impressing them with patterns during the operation of making; secondly, embossing paper with patterns for the same purpose, after the paper is made, and which, by the pressure it receives during this operation, is made to resemble plain damask or figured silks; thirdly, in uniting two or more thicknesses of paper together for the same purpose, previously to their receiving the embossing, one of which may be coloured paper, and the other white; fourthly, in uniting for the same purpose, paper with silks, velvets, and other fabrics, so that, if plain, they may receive an impression or pattern by embossing, and may also be struck on walls with the same facility as paper only is commonly done; and, fifthly, in the apparatus for uniting the paper or papers, and other fabrics, as above mentioned. First, in some cases, I make a coloured or tinted paper, and in doing this, I dye or stain the rag or pulp by any of the known methods of dying or staining them, and make it into paper in the usual way; and during the process of manufacture, and before it is dry, I cause it to pass between rollers, and receive an impression therefrom, one or both of which rollers are engraved, stamped, or impressed, or covered with something that will give the pattern or figure required, by which operation it is impressed, and receives a pattern or figure; or the same thing or effect may be obtained by using plates or other flat substances, in or on which the required pattern or figure is formed, by laying them on the paper in its way to the pressing rollers, so that in passing through them, it receives the figure or impression.

"Secondly, in other instances, and particularly where I want a shining article to resemble silk, I make my paper as before described, by any of the known methods, and when dry, I pass it through rollers, one or both of which are engraved with the pattern required, and at least one of them heated, so that the impression obtained may be stronger and more shining; and it is not necessary the paper for this purpose should be always coloured or tinted in the rag or pulp during the process of manufacture, but either coloured paper so made, or paper which has been made white, and afterwards coloured by any of the known methods, will do equally well for this purpose; neither is it necessary the paper should be made in long lengths, although I prefer it so, and it may either be made so by machinery, or a number of sheets may be joined together, or sheets may be impressed by either the heated rollers or plates passed through heated rollers, and united in putting them on the walls so as to form the pattern intended, when combined. In some cases, I give part of the impression during the operation of making the paper, by which it is twilled or lined, ribbed or striped, by passing it through rollers prepared according to the purpose intended, which causes it to appear thicker than if pressed flat and smooth, and prepares it to receive a stronger impression; and I afterwards, when nearly or quite dry, pass it through other rollers, one or both of which are heated, and on which are other patterns, so that part may be shining and other parts not so; and whenever it is particularly desirable that the paper should retain its shining quality in a greater degree, I size it strongly with animal or vegetable substances, and sometimes use gums or wax therein.

"Thirdly, I contrive to unite two or more thicknesses of paper together, either during the process of making, or afterwards, by introducing between them any of the glutinous substances, or articles, calculated for the purpose, and one of these papers may be of any colour required for the outside, and the other may be coloured or white for the back, and may also be of a coarser and stronger description than that which is intended for the outside: and when these papers are so united, they are passed through the pattern and heated rollers, or pressed with the plates as before described, to give the pattern required: and in general I prefer these double or compound papers to those which are of one sheet or thickness only, as they take the impression and preserve the patterns better, and are less injured by the operation of pasting, in putting them upon the walls.

"Fourthly, instead of the double paper before described, I take plain or figured silks, satins, velvets, cottons, linens, or other fabrics for the one side, and unite these with paper by introducing any of the glutinous substances, or articles calculated for the purpose, between them, in the way before described when two or more thicknesses of paper are used; and when so united, if the article is plain and wanted to be figured, I emboss it with any pattern required, in the manner before described, and by ribbing or twilling it, by passing it through rollers prepared to give it this appearance after it is united with the paper, I give an inferior silk the appearance of a much more valuable one, and allow of the paper thus united being pasted and stuck on walls in the same manner, and with as great facility as though it were paper only.

"In either of the cases before mentioned, I produce the embossing effect by means of a swing press, where the figure or pattern occurs but seldom, to the screw of which press a plate with the intended pattern is attached, having a chamber above it to receive a heater, for the purpose of making the impression stronger and more lasting. With this and the other modes of embossing, I sometimes use leaf gold, or other metallic substances, so that the whole, or part, of the impression may be covered thereby, (as in the binding of books,) and in some cases I take paper which is already covered with gold, silver, or other metallic substances, and emboss and cut out the figure intended, so as to fit the impression made in embossing. In other cases, and particularly when plain silks are united with paper, I produce a pattern, or effect, called watering, by pressing two thicknesses or pieces together between heated rollers, or in a press face to face, so that during the operation of pressing, one may bruise the other, and produce the effect described.

"The patterns intended to be employed for the above purpose, admit of all the varieties of engraving and impressing, which can be used for embossing, in the manner before described, and they may be made to appear as though they were woven in the material, or embroidered or embossed thereon, according to the article which it is intended to resemble, the intention being to make paper appear like silks, cloths, &c., of greater value than itself, and to have a similar effect in improving the appearance of silks, or whatever articles are united or combined with the paper; and the novelty of my invention consists in giving the improved appearance in the manner herein described, to papers intended to be applied to the purposes of covering walls or hanging rooms, as above stated; I do not claim any thing new in the process of making paper, farther than what is described under the first head, viz. the method in which the figure or impression is given during the manufacture of the paper for this particular purpose; and though embossing has been used for various other purposes, yet I claim it as new when applied to papers prepared in the manner described, or when united with other fabrics for the purpose of covering walls or hanging of rooms, as above said."

[*Lond. Jour.*

To WILLIAM DETTMER, *Piano Forte Maker, for his invention of certain improvements on piano fortes. Sealed* 30*th August*, 1827.

THE object of the patentee in adapting this invention to piano fortes, is to enable the instrument, after having been properly tuned, to be brought into unison with other instruments of a different pitch, by raising or lowering the tone of all its strings by a simple operation, instead of the trouble of tuning each string separately.

The plan applies both to grand piano fortes and square piano fortes, and whether horizontal or upright, and consists in adapting to the ordinary construction of instruments, a series of tension bars or rods, with adjustments which are to extend across the instrument, and to be connected to the block in which the pins that hold the strings are fixed, the blocks being moveable for a short distance, not more than a quarter of an inch, but confined by the tension bars.

The general construction of the piano forte, as to the keys and movements, and the arrangement of the strings, the blocks for the hitch pins and for the rest pins, being the same as in other piano fortes, the novelty consists in attaching the ends of a series of metal bars, or rods, to the hitch pin blocks, and connecting the reverse ends of the same bars to the rest pin block; these bars being enabled to elongate or contract by means of adjusting screws.

Supposing each of the strings of the instrument to have been drawn up by the turning key to the required note, that is, properly tuned, but that when so tuned the whole should be found to be too flat or too sharp to play in concord with other instruments in a concert; by simply moving the adjusting screws of the tension bars, the blocks to which the strings are attached will be brought nearer together to flatten the tone, or farther apart to sharpen it, as may be required, without deranging the tone or notes of the individual strings.

The patentee says that both the blocks on which the strings are hitched, and that in which the rest pins are set, may be made to slide, but he prefers that the rest pin block only should move, and this may be done by passing the adjusting screws through the block into the tension bar, when, by turning the screws, the block will be moved a short distance, and the tension of all the strings will thereby be increased or relaxed.

The same effect may be produced by means of wedges or levers, or some other contrivances, in place of the screws, but that which has been described is preferred. [*Ib.*

To JOSEPH HORTON, *boiler maker, for his invention of a new and improved method of forming and making of hollow cylinders, guns, ordnance, retorts, and various other hollow and useful articles in wrought iron, in steel, or composed of both those metals. Sealed* 11*th October*, 1827.

THESE hollow cylinders are proposed to be made by combining a series of bars of iron or steel, placed lengthwise round a cylindrical mould, and after bracing them together by means of iron hoops, and raising the temperature of the whole in a furnace to a welding heat, the mass is to be beaten with hammers upon a mandril, until all the pieces are united in a solid compact state.

It is proposed that the several bars shall be made in a small degree wedge-shaped in their sectional figure, in order that they may lay close together, when combined in a cylindrical form, like the stones round the arch of a bridge.

Several modes of effecting this object are proposed beside the wedge form, as, for instance, a series of square bars may be laid, with triangular bars intervening, or some other mode may be adopted for bringing the sides of the bars nearly into contact, before they are submitted to the heat of the furnace; and when so heated, to a welding state, the joints may be closed by tilt hammers, or by sledge hammers, as may be most convenient, according to the magnitude of the cylinder about to be made.

The plan is proposed for making cylinders of iron or steel for any purpose, but particularly for ordnance, which may be formed by these means, observing that the bars for that purpose, must be thicker at one end than at the other, in order to afford such additional substance, as may be required towards the breech part of the piece.

When the gun has been thus formed upon a mandril, and all the joints of the combined bars rendered perfectly sound by the operation of welding, it may be bored within, and turned without to its proper figure, and will be a much better and stronger gun than any heretofore made by the ordinary process of casting. [*Ib.*

Patent granted to S. SMITH, *Builder, for certain improvements in chimneys for dwelling houses, December* 14*th*, 1830.

THIS patentee proposes to constitute chimneys, or rather flues, of iron tubes to be cast of appropriate lengths and diameters, according to the intended capacity of the flue. These are to be built into the wall, and constitute a circular opening lined with iron. Each piece of pipe is cast with one end somewhat enlarged, to receive the smaller end of the succeeding piece, and when the chimney flues are to be turned from the straight course, kneed or bent pieces of pipe are introduced to give any required curvature.

In addition to the introduction of cast iron tubes, to constitute chimney flues, Mr. Smith claims the invention of a method regulating the size of the flue at the foot of the chimney, by the application of a pair of hollow iron cones, attached at their bases, which must be made equal to the flue in diameter. A cross piece is attached to the apex of the upper cone, whose ends move in slots made for their reception in the lower piece of tubing. From each of the cross bars two chains pass over two pulleys fixed in the chimney, a small distance above the cones, where the two chains are connected, and passed down through an aperture coinciding with the axis of the cones, where it is furnished with a counterpoise. And by this the cones may be elevated so as to close the chimney entirely, and to answer the purpose of a chimney board, when fires are not wanted; or they may be lowered to regulate the opening to any assignable size, according to the required draft, depending upon the quantity and kind of fuel employed.

There is nothing new in the first part of this patent, for a plan of making flues of iron pipes was proposed several years ago.

Mr. Smith's method of adjusting the size of the flue to the draft required appears to be new, and likely in many cases to prove useful.

[*Regis. of Arts.*

Patent granted to MICHAEL DONOVAN, *of Dublin, for an improved method of lighting places with Gas. April* 16, 1831.

IT is a well known fact that hydrogen gas, obtained from the decomposition of water by its being passed through red hot iron, or masses of ignited charcoal, will readily burn if lighted when it comes in contact with the oxygen of the atmosphere as it issues from a pipe; and that its illuminating powers under such circumstances, are so small as to render pure hydrogen inapplicable to the purposes of gas lighting. To augment the illuminating properties of hydrogen, generated under such circumstances, by the admixture of some other gaseous material, is the object of Mr. Donovan's invention. He proposes to convert spirits of turpentine, or similar substance, into vapour by the heat of the gas burner itself in the following manner:—

The hydrogen gas in its passage to the burner passes through a metallic cavity immediately connected with the burner, and in this cavity is introduced a quantity of wire gauze to give extended metallic surface. Into the interior of this cavity is introduced a constant supply of turpentine, which being spread over the metallic surface of the wire gauze, becomes, by the heat of the burner, converted into vapour in the cavity where it mixes with the hydrogen;

giving to it a sufficient quantity of carbon to produce the illuminating powers required. If too much of the vapour of turpentine be mixed with the gas, the issue of an inconvenient quantity of smoke from the burner will take place; and when too small a proportion of this vapour is introduced, a deficiency of light will be the consequence: and, therefore, great care must be taken to proportionate the size of the burner, the supply of hydrogen, the size of the metallic cavity and surface, and the supply of turpentine, to produce the greatest quantity of light with the least smoke. [*Ib.*

Patent granted to BENJAMIN ROTCH, *Barrister at Law, for improved Guards, or Protectors for horses' legs and feet, under certain circumstances. March* 18, 1831.

THE improved guards here contemplated are to be made of caoutchouc. When it is to be applied to a horse's foot the neck is to be cut from a caoutchouc bottle, it is then to be softened by immersion in hot water, and drawn over a block made in the form and size of the foot for which it is intended. On this block it is permitted to cool, when it will retain its shape, and by its elasticity it will adhere to the horse's foot when drawn on it. On the exterior of this shoe is to be applied a sole of sheet iron, made of sufficient size to allow of its edges being cut and turned up round the hoof, to keep it on the foot, but it is also fastened to the Indian rubber by means of very broad and thin round headed rivets; and to the iron sole may be fastened, if required, horse shoes of the usual form.

A method of making and applying the guards for the legs of horses is next described in the specification. For this purpose both the top and bottom of the caoutchouc bottle are to be cut off, the middle piece is then to be soaked in hot water to soften it, and cooled on an appropriate block, as before. One or more of the elastic bands thus prepared are to be applied to such of the legs, or to the knees, of the animal, as require protection; and they will be preserved in their places by the elastic nature of the substance. When they have been laying by in cold weather, they are apt to get hard, and in that case it is recommended that they should be warmed before they are applied. When they are to be used as bandages it may be sometimes necessary to cut them and fasten them with straps and buckles, and in that case the straps must be attached to the caoutchouc at some distance from the edge, otherwise they will be apt to be torn off.

The drawings attached to the specification represent a horse's fore and hind leg, with the guards applied to the feet and fetlock, and to the knee, as well as at the top and bottom of a cloth with a poultice applied to the leg.

With respect to the time, (*twelve months,*) which this patentee has obtained for preparing his specification, we think it deserves notice as a curious illustration of the *laws' delay;* for nobody but a lawyer would have thought of requiring, and very few would have had the means of obtaining, a whole year to mature and describe that which almost any person at all acquainted with the subject would have readily accomplished in half an hour: for here are neither delicate experimental investigation, requiring time to mature and repetition to confirm, nor intricate mechanical construction, requiring the confidential aid of others to bring to perfection.

We consider that the different periods allowed by the present practice to different patentees for the enrolment of their specifications, is one of the principal defects of the system: and Mr. Rotch, from the experience that he has had in that branch, and to which he recently said to a committee of the House of Commons, that he had directed particular attention, cannot but be aware, that if A, for instance, takes out a patent for an improvement in the steam engine, and takes twelve months to enrol the same, and B subsequently takes out a patent, also for improvements in the steam engine, and obtains but two, four, or six months to enrol his specification, there is nothing to prevent A from inspecting B's specification in the enrolment office, and adopting it as his own; as he was not required to give any description of his invention at the time he obtained the patent.

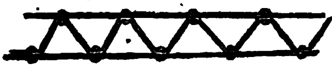
It is not a little singular, that Benjamin Rotch, Esq. of Bath, on the 11th of May, 1816, took out a patent for "a flexible elastic horse shoe," consisting of "two or more pieces of iron, steel or any other metal, attached either by the nails which fasten the shoe to the foot, or by rivets expressly for the purpose, or sometimes by both, or otherwise fastened or applied to one or more pieces of leather, hat, *Indian rubber*, or any other flexible substance." The application to this circumstance of the following extract from the evidence of Benjamin Rotch, before a committee of the House of Commons, on the patent law, will readily occur to the reader:—

"Look, (says he,) at the danger of allowing patents for improvements, even with the consent of the party, on articles that are already patented; it would continue a patent *ad infinitum:* improvement on improvement, just as their fourteen years are expired; because it is what patentees come to me constantly to know, if they cannot, for some little improvement, obtain a patent on their own patent, which would be an extension of the term to twenty-eight years instead of fourteen, and thereby shut the public out of the benefit they are to have at the end of fourteen years."

Now it would be very interesting to know whether Benjamin Rotch, of Bath, in 1816, be any relation, or at all connected with Benjamin Rotch, of London, in 1830.

Patent granted to WILLIAM CHURCH, *for certain improvements in the construction of Boats and other vessels. March* 9, 1831.

MR. CHURCH proposes to employ sheet iron in the construction of boats and other vessels, as well as for rail-way carriages. The iron plates are to be united by riveting, in a manner similar to that adopted in the construction of steam boilers; and the joints must be all made air and water tight. The exterior of the boat thus formed, is furnished with a lining similarly constructed. A space of a few inches is left between the exterior casing and the lining; and in this space is introduced a series of iron plates bent into the form represented in the cut, to give strength to the vessel. These strengthening plates are secured to the casting and lining by rivets or bolts, and the space between the linings is enclosed at the top, air tight; and by that means much buoyancy is obtained from it in cases of danger when the boat fills with water. The deck of the vessel is also to be made of plate iron, which is to be secured and strengthened in a manner precisely similar.



To prevent the mast from being injured by the edges of the iron plates, a piece of iron tube, of dimensions to correspond with the diameter of the lower end of the mast, is introduced through, and firmly secured to, the deck.

The top rail of the bulwarks is made of iron tubing connected together by passing their ends into sockets, and connected with the sides of the vessel by iron plates bent in the form of the surface of a pantile roof, to give them strength.

A description of the Economical Oven, or apparatus for procuring alcohol from dough in the process of baking bread.

Under the head of *New Process of Distillation*, at page 417 of our last volume, we gave some account of the invention for which a patent was granted to Mr. Robert Hicks of London, by which the alcoholic vapour arising from fermented dough in the process of baking, was condensed and collected. We have now procured a drawing of the apparatus employed, which will serve to render the mode of procedure perfectly intelligible. This drawing, with the accompanying description, we have copied from the Register of Arts, for February last.

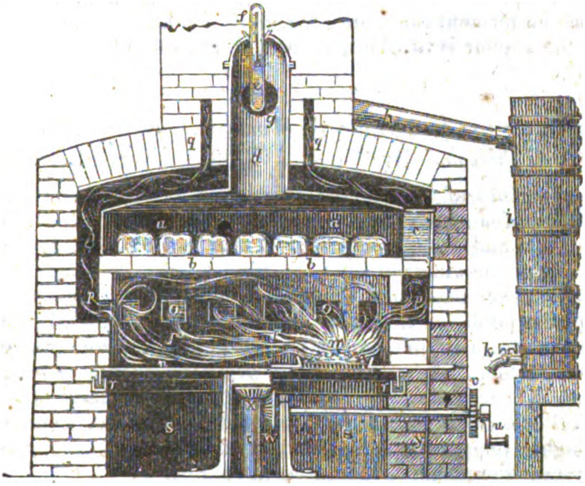
It will be readily conceived that the numerous small fissures in an ordinary oven of *brickwork*, arising from imperfect fittings and other causes, render the material unfit for the preservation of the vapours given off: Mr. Hicks accordingly employs an oven made of *iron* in lieu of brick; but the bottom of the oven on the interior side is lined with a pavement of bricks, on which the loaves are placed as usual; a fire is made underneath the oven, at a proper distance, and brick flues from thence are so arranged that the heated air shall envelope every part of the exterior of the oven, to diffuse the heat in the interior of it as uniformly as is practicable. The door of the oven is made to fit the frame accurately, by grinding their surfaces, or by luting when set to work, and these parts are brought into firm contact by a cross bar and screw in the usual manner of fastening the mouths of retorts.

In the drawing accompanying the specification, two modifications of the apparatus are exhibited. The first is an oblong oven five feet wide and seven feet long, and the fire place, or grated receptacle for the fuel, is placed underneath the middle of the bottom, and is framed so as to be drawn, parallel with the length of the oven, backward or forward, or to be drawn entirely out of the apparatus when required. By the usual position of the fire, however well regulated may be its intensity, there is a liability of the central part of the bottom of the oven to become overheated; partly owing to the bottom being lined, internally, with so bad a conductor of heat as bricks. To protect the oven from this injurious effect, a large plate of iron, about half the area of the oven, and twice that of the fire, is suspended by a hooked iron bar centrally to the bottom of it; and being posited about midway between the fuel and the bottom of the oven, prevents the flame and heated gases from acting directly upon the bottom of the oven. The door of the ash pit is provided with an air regulator, and the minor flues around the oven, (made by numerous holes in the brickwork,) unite in the upper part, where a horizontal flue leads into a common chimney.

In the centre of the top of the oven a large iron tube or neck, about twelve inches in diameter and thirty inches long, is fixed vertically, extending through the brickwork which covers the oven. In this tube the vapours from the bread are collected, and are conducted from thence, by a lateral tube, into a common distiller's worm, which being surrounded by cold water the vapours become condensed, and are drawn off into a proper receiver for the liquid. This liquid, consisting of a mixture of water, alcohol, and other matters, which being afterwards rectified, will furnish a fine spirit of wine.

In order to regulate the temperature of the oven, an iron tube about the size of a musket barrel, closed solid at the lower end, and about a foot long, is suspended vertically in the middle of the neck, by passing through a tapered hole in the top of the latter, whereon the tube rests by its upper end, which is spread out into a conical or bell-mouthed form for that purpose. In this tube oil is deposited, and into the oil is placed the bulb of a thermometer, whose graduated scale above, extending outside of the apparatus, exhibits the temperature of the oil, and, consequently, also that of the oven.

The other modification of the machine described in the specification varies from the preceding in the arrangement of the furnace part. In the first, the fire-grate was *stationary* during the baking; in the second, which we have now to describe, it is made to *revolve*. For this purpose the oven is made circular, and at a suitable distance from the bottom of it, (about a foot,) is a large circular plate of the same diameter as the oven, (six feet,) which turns in a horizontal plane, on a vertical axis, forming a complete partition between the fire place and the ash pit; except in a portion of the circle where the *fire grate* is situated, which is nearly of a sectoral form, to afford a more uniform distribution of the heat, and a greater facility of pushing the grate into, or drawing it out of, its place, under the oven. In order that the air which is admitted into the ash pit to promote the combustion may not be diverted from its proper course, that of passing through the grate on which the fuel is deposited, the patentee makes the whole circumference of the revolving plate air tight by what is termed an hydraulic joint. Near to the periphery of the circular plate, is fixed a descending rim of three or four inches deep, which dips into a circular trough, filled with water, that rests upon the brickwork surrounding the ash pit; and the revolving plate being wholly supported upon its central axis, the part of the apparatus is rendered as complete in its action as it is simple in form. The motion is communicated to the grate by bevel gear of the usual kind.



The preceding cut affords a sectional view of the last mentioned modification of this baking and distilling machine. *a a* is the iron oven; *b b* the brick floor made level with the bottom of the doorway *c*; *d* the chamber where the vapours from the bread are collected; *e* the oil tube suspended by its bell-mouthed end in a hole at the spherical extremity of the water chamber; *f* the thermometer with its bulb immersed in the oil contained in the tube; *g* a large aperture through which the vapour escapes into the crane neck, *h*, leading into the refrigerating worm tub, *i*, wherein the vapour becoming condensed is drawn off by the cock, *k*, into a proper recipient. *l l* is the fire place, of which *m* is the grate, resting between ledges on the large circular revolving plate *n n*; *o o o* are lateral apertures or flues in the brickwork, leading to the general surrounding flue, *p p*, which terminates in the flue, *q q*, leading to a common chimney, not represented in the drawing. *r r r* shows the circular water trough into which the descending rim of the revolving plate dips throughout its circumference. *s s* is the ash pit; *t* the vertical axis of the revolving plate, to which motion is communicated, either by a boy turning the handle *u*, (or any convenient power applied to the pulley *v*,) which actuates the bevel gear W and X. At Y is the register to regulate the admission of air to the fire.

When the thermometer indicates a temperature of 280° Fahrenheit, the oven is at a proper heat for the baking of bread, during which process, the heat should be maintained at from 280° to 310°, and the vapour drawn off through the refrigerator, for subsequent rectification to obtain the vinous spirit. After the bread has been baked, and the pastry, (as customary,) is introduced into the oven, the action of the condensing apparatus is dispensed with; which is effected by turning the cock at the worm tub, and the oil tube and thermometer being withdrawn, the vapour escapes at the aperture thereby left open. In the baking of biscuit also, which, like pastry, undergoes no fermentation, and, therefore, contains no alcohol ready formed, the vapour is in like manner suffered to escape.

Remarks on the use of Surcharged Steam, with an account of experiments thereon.—By William T. Haycraft, M. D.

The Repertory of Patent Inventions for July last, contains the specification of a patent for improvements in the steam engine, by Dr. Haycraft; and the same number furnishes the following remarks explanatory of the views of the patentee.

The invention described in the accompanying specification, is offered to the public in the full confidence that it is a real improvement on the steam engine, and well worthy the attention of scientific and practical men. I have for many years pursued a series of inquiries on the mechanical properties of steam, especially of what is usually called surcharged steam, i. e. of steam that has been subjected to a higher temperature than that at which it was generated, in which process the steam is increased in volume, with a proportionate increase in mechanical power; the process itself being effected at a comparatively small expense of fuel. In pursuing these inquiries, I have found from the effects of surcharged steam in several experimental engines, that when the cylinder is properly constructed, the power produced is far greater than that from ordinary steam. Encouraged by this success, a 12 horse power engine has been erected, which in its working, has proved the truth of my principles in a most satisfactory manner.

It will, however, be proper, before giving a more full account of this engine, to endeavour to correct some errors which practical and even scientific men have fallen into, concerning steam when applied to produce power, which I shall endeavour to do in the most familiar language the subject admits of.

It is generally supposed, that if steam be heated above the temperature at which it is generated, its force is not increased; that it is even diminished; that the super temperature, by some means or other, kills or destroys its elasticity. I will first endeavour to show how this mistake has arisen.

The following experiment was made by Mr. Perkins, assisted by Mr. Penn, Jr. at his steam engine manufactory at Greenwich, and similar experiments have been made by others.

Surcharged steam was made by passing small quantities of water through a system of cast iron tubes, heated to a high temperature. This surcharged steam was applied to Mr. Penn's engine of, I believe, 6 horse power; after a short time the engine lost its power, namely, as soon as the cylinder had acquired a super-temperature, although there was abundance of steam.

What could be the cause of this? Most practical men would say that the surcharged steam had lost its elasticity, and, therefore, its power to work the engine. Messrs. Penn and Perkins, however, discovered the fault and endeavoured to remove it. The fault was that as soon as the cylinder became considerably heated, the packings of the piston and piston rod could no longer confine the steam, and it appeared on examination, that these packings had become completely dried, and therefore easily permeable by steam—that, consequently, its force could not be exerted on the piston. To remedy this, the surcharged steam was first passed over the surface of water contained in a second boiler, by which process it rapidly absorbed water till it was saturated, when the engine worked perfectly well. The reader will, however, perceive that in this case, the surcharged steam, by imbibing an additional dose of water, was converted into ordinary steam, which is disposed, when introduced into a working cylinder, to deposit a portion of its water; because the cylinder is of a lower temperature than the boiler. This water, by moistening the packings, renders them, to a certain degree at least, steam tight. The same fact has been observed in condensing engines, when, from the boiler being by accident almost empty, and the fire being urged, so that the upper part of the boiler was extremely heated, and the steam thereby was surcharged. In this case, although there is abundance of steam of the usual pressure, the engine will not do its work.

We had an excellent opportunity of observing this *apparent* want of power in surcharged steam, in an experimental condensing engine. In this engine the steam was surcharged by means of high pressure steam surrounding the cylinder. The piston was provided with metallic plates, which acted well: the piston rod had the usual hemp packing. The engine worked well for some time, until the piston rod had become considerably heated, and its packing dried, when all at once a rushing of air was heard through the packing, and quantities of air were pumped up by the air pump, and the engine lost its power. The power could be restored by moistening the packing, or by pouring in quantities of oil, which latter however passed through with the greatest rapidity.

From the foregoing observations it will appear, that the *apparent* want of power in surcharged steam, is to be attributed to the great difficulty of keeping the joints and packings tight, arising from the disposition which surcharged steam has of drying and injuring the packings.

The experiments from which we some years ago directly proved the *increased* power of surcharged steam, are very simple. They consisted in accurately weighing a copper ball containing steam of the boiling temperature, then by immersing the ball in heated oil, till it attained the temperature of 312°, allowing the surplus steam to escape by a small orifice, which was subsequently closed very accurately; then by subtracting the weight of the empty ball from the two weights, it appeared that steam surcharged to 100° above the boiling point, weighs $\frac{1}{10}$ of ordinary steam, it being still able to bear the atmospherical pressure; thus one volume is converted into ten volumes, each of which, if its temperature be preserved, will produce a mechanical power equal to the original volume; that is, we increase the whole power ten-fold.

Then the question became, how can we confine this surcharged steam so as to make it available to produce power? We have already seen, that it is from its disposition to dry the packings, that surcharged steam so freely escapes in waste. After a number of experiments with different fluids, my brother and myself found that water, when interposed between the surcharged steam and the piston, was capable of effecting our object. It is well known that water passes through compact organized porous bodies with great difficulty. This is shown in the hydraulic press, in which water under a pressure of several thousand pounds on the square inch, is kept tight by a simple collar of leather. To be assured of the practicability of this to the steam engine, a model was constructed which was so arranged that water could be introduced between the piston and the working steam, or not, at pleasure. When the water was not interposed, there was a waste of steam through the packing at a pressure of 30 lbs.; but when water was interposed, the engine worked perfectly tight at a pressure of above 600 lbs. on the square inch.

Thus we arrived at two important facts; first, that steam is capable, by receiving a super-temperature, of increasing its power in a ratio equal to its increase of volume; and, secondly, that by the intervention of water between the steam and the packing, we are able to make a perfect joint completely impermeable by steam. It would be evident, however, that if water were interposed directly between the surcharged steam and an ordinary piston, it would be soon dried away, and our intentions would be defeated. For the purpose of obviating this, the arrangements as described in the specification, have been made, and the truth of the principles laid down completely put to the test. In an experimental engine, the effect of the surcharged steam is very extraordinary. When surcharged steam is used, the engine does not require one-tenth part of the steam, and what is singular is, that the power of the engine is improved thereby. In this engine, the boiler is not sufficiently large to supply steam of 30 lbs. on the inch, but the moment the steam is surcharged, the steam pressure rises in the boiler till it arrives at 200 lbs., the engine going with its full power the whole of the time, after which the escape by the safety valve is evidently greater than the quantity consumed by the engine. The surcharged steam, after escaping from the engine, is perfectly invisible, so that no appearance of steam can be observed at any time. This shows the extreme rarity of surcharged steam. In the 12 horse power engine that has been erected, we have not attempted to surcharge the steam to so high a degree, for reasons that shall be given, yet its action is equally satisfactory.

There is another point very important to practical engineers, which seems to have escaped the notice of writers on the subject, and was equally unknown to the celebrated Watt, namely, the production of cold *within* the cylinder, occasioned by the evaporation of water deposited on its internal surface. This evaporation takes place every time the vacuum is formed, it of course occasions a production of cold, which in its turn causes a fresh deposition of water, and waste of steam. Although Mr. Watt does not appear to be aware of these series of actions taking place, yet he was perfectly sensible of the great utility of preserving the temperature of the cylinder. For this purpose he used to surround it with steam from the boiler, thinking it to be sufficient to prevent condensation, that the cylinder should be kept at the same temperature as the steam. Had he been aware of the cooling process we have described, he would probably have perceived, that to prevent the evil, it would be necessary to surround the cylinder with steam of a *higher* temperature than that of the working steam; in which case no condensation would take place with the consequent evaporation, cooling of the cylinder, &c. In doing this, however, a practical difficulty presents itself; for if this be attempted in ordinary engines, the water is no longer deposited, and, as we have before shown, the packings become dry, and no longer steam tight. The intelligent reader, on examining the principles of the surcharged steam engine, will perceive, that this drying of the packings cannot take place, although the surcharged end of the cylinder should be raised to ever so high a temperature, the presence of water on the other side of the piston will always effectually preserve them from drying or other injury.

We have sufficient proof of the correctness of these principles in the action of Woolfe's engine. It has been supposed that the saving of fuel in this engine, arises from the use of two cylinders, one of high pressure and the other a condensing cylinder; the escape of the former working the latter, in which arrangement the steam acts by expansion, as it is termed. That the saving is not entirely occasioned by this cause, was shown by an accident which happened in an engine of this description at Mr. Newcomb's mills at Stroud Water. The reader is aware that the condensing cylinder in this engine is surrounded by high pressure steam; now it happened that the high pressure steam jacket was injured, so that the engineer blocked up the pipe leading into it; in this state, the cylinder was no longer surrounded by high pressure steam, of course the working steam was no longer surcharged; the consequence was, that the engine could no longer do its work. The jacket, &c. being repaired, the engine then went perfectly well. In this engine hemp packings are useless, for the reasons given, instead of which metallic pistons are used, which, when the steam is only slightly surcharged, and of a moderate pressure, answers sufficiently well.

There is also a great advantage in using steam of a higher pressure than can be used in engines of the ordinary construction. My brother, Mr. Samuel Haycraft, has found in using high pressure steam, that in increasing the pressure, the quantity of steam expended is not increased in the same proportion; that, in fact, the quantity of steam expended, is only as the *square root* of the pressure; that is if we increase the pressure four-fold, the quantity of steam required will be only twice as much, by which in proportion to the power produced, there is a saving of one-half: If we increase the pressure nine-fold, the quantity of steam is increased three-fold, by which there is a saving of two-thirds of the steam, and so on in the same proportion. But this cannot be effected to any great extent in ordinary engines, because the packings are not sufficiently tight at high pressures. But we have shown, that by means of the arrangements proposed in our improvements, our packings are able to sustain a pressure of more than 600 lbs. on the square inch, without leakage. It is by a combination of the principles of working high pressure and surcharged steam, that the greatest advantage is to be derived: thus, we found in the experimental engine, working at 200 lbs. pressure on the square inch, with surcharged steam, the expenditure of steam was only one-tenth of the quantity used, when unsurcharged steam of 30 lbs. on the inch was used: thus the power compared to the quantity of steam, was increased more than sixty-fold, the engine working perfectly tight.

The 12 horse power engine referred to, has been constructed agreeably to the plan laid down. The boiler is of a size usually adapted for a 4 horse power engine, and it works the engine at its full speed, and at a full power of twelve horses, calculating 220 lbs. pressure on the piston for each horse, exclusive of friction. The boiler evidently makes more steam than is necessary, the steam constantly escaping by the safety valve, when the engine is going at its full power, although the fire is kept low, and the boiler is only set in a temporary manner, with a very short chimney. The engine also works under the disadvantage of being completely exposed to the open air. The boiler is of the strongest form, being a cylinder twenty-six inches in diameter, and ten feet long. It is made of the best forged iron; and has been proved to above 500 lbs. on the square inch. This engine is computed to consume one-half a bushel of coals per hour, being about one-half of the quantity required in a Woolfe's engine of the same power.

In this engine we have not attempted to carry the surcharging and high pressure to its greatest extent, as without so doing, the effect sufficiently answers our expectations, and the saving of fuel is so great as to make any further saving, at least in a fixed engine, of comparatively small consequence.

But the superiority of this engine is not confined to its saving in coals, for it is evident that its saving in water is still greater. When we consider that in all engines, and especially in high pressure ones, a great quantity of water is thrown up from the boiler into the cylinder with the steam, which has been estimated by practical men to be full one-half of the whole quantity used, we shall perceive that as by the surcharging plan the whole of the water is converted into steam, the saving of water will be twice as great as the saving in steam. Now the saving in steam is, on the lowest calculation, *com-*

pared with ordinary high pressure engines, three-fourths of the whole quantity, the surcharged steam engine requiring only one-fourth of the coals, will require only one-eighth of the water. In applying this to the subject of locomotive engines, we will consider it in the following way:—First, the load required for supplying the engine, consists of one part of coals to six parts of water, because one pound of coals will boil off six pounds of water. Therefore, if we suppose the load necessary to supply the engine, to be two tons, the weight

of the coals would be - -	Cwt.	5	2	24
The weight of the water, - -		34	1	4
	Cwt.	40	0	0
By the use of the surcharged steam engine, the quantity of coals will be - - -		1	1	20
The weight of water - - - -		4	1	4
		5	2	24
So that there would be a saving of the load required, equal to - - -	Cwt.	34	1	4

The great advantage of lessening the load in a locomotive engine, especially if intended for the road, is self evident; it will in effect be increasing the power of the engine, and of course the velocity of the carriage. Also, by thus lightening the load necessary for the engine, we shall be able to carry such an increased supply, that we shall be enabled to travel three or four times the distance without fresh loading. We shall also be able to increase the *steam power* to a great extent.

It must be familiar to the reader, that the two obstacles to the complete success of locomotive engines on the common road are, the want of steam power adequate to the load required, and the too frequent necessity for stopping to take in a fresh supply of water and coals. These two obstacles the surcharged steam engine will completely remove.

The surcharged steam engine may also be made more compact in its form than any other, arising chiefly from the smallness of the boiler, or generator, required.

It should also be observed, that this estimation of the saving of fuel and water, is on the least favourable scale. I have shown, that by combining a considerable steam pressure, (200 lbs. on the inch,) with completely surcharging the steam, the power produced was increased sixty-fold, compared to that produced by an equal quantity of steam not surcharged. This almost incredible effect was produced by the application of a moderate fire directly to the surcharged part of the cylinder. This engine has been frequently worked in this manner for several hours during many months, yet, although the cylinder is of brass, it was never in the least injured by the fire; also the piston packing and the other joints were always perfectly tight. Even should it be apprehended, that in the course of time, the cylinder might be injured, that part of it which is exposed to the fire may be replaced in a few hours, by a new spare piece, without in the least disturbing the working part of the cylinder, piston, &c. On this plan, the saving of steam may be carried on to an almost unlimited extent.

The only objection of moment which has been made by the many practical men who have seen the engine is, that owing to the large size of the piston rod, which, in fact, may be considered as a second piston, there is an increase of friction. This is certainly true, but at the same time, the advantages arising from the arrangement are so great, and the power is so much increased, that it must be considered in the same light as Watt's addition of the air pump to the condensing engine, which although from its friction, &c. it requires some power to work it, yet at the same time, it adds so much more power to the engine, that, on the whole, it is a real improvement. From the small size, however, of the cylinder in this engine, it is evident that its friction must be less than that of a condensing engine.

Many also object to the use of high pressure engines, from a mistaken idea of the danger attending them. Perhaps, on the whole, however, they are even safer, owing to the greater precaution used in having a boiler or generator of the greatest possible strength. In the engine we have erected, the boiler has been proved to above 500 lbs. on the square inch, so that it would require an error of more than 400 lbs. on the square inch to render it unsafe, which error can hardly happen: on the other hand, few low pressure boilers would be safe at a pressure of 25 lbs. on the inch, so that an error of 20 lbs., should the safety valve be obstructed, would be dangerous. In the surcharging engine especially, the boiler is so small, that its safety is secured. The reader is aware that Woolfe's engine, as improved by Mr. Hall, works with a high pressure boiler, yet its working gives general satisfaction. The surcharged steam engine may indeed be considered nearly the same in one of its principles with Woolfe's, namely, the working with surcharged steam, excepting that in the latter, the steam is only very slightly surcharged. In our engine, the steam is completely surcharged, and the full advantage of the principle is thereby obtained. Woolfe's engine also, being on the condensing plan, cannot of course be used for locomotive purposes, and from its being somewhat complicated, perhaps is not quite so well adapted for navigation; although for mills, &c. it is the best engine hitherto known. The surcharging engine, from its compactness, its great saving in coals and water, and its increased power, is peculiarly adapted for these purposes, and I have but little doubt but that its use will eventually become general.

To express in a few words the principal feature of the surcharged steam engine, we would say, that it accomplishes the important desideratum of having a perfectly steam tight piston packing. It should be recollected, that it was the opinion of the celebrated Watt, that the chief cause of the waste of steam in the steam engine, is the want of tightness in the piston; and it is known that he laboured many years in endeavouring to effect this object. Since that time, it has been attempted by many of the most skilful engineers without success.

The other feature is, that by means of a prolonged piston or plunger, there is a complete separation between the surcharged end of the cylinder and its working part, by which means, the steam can be worked in a completely surcharged or rarefied state, and the piston, being also covered with water, is effectually preserved from injury.

Remarks on the construction and peculiarities of the four Engines employed at the competition for the prize given by the Liverpool and Manchester Rail-way. From Wood's Treatise on Rail-roads. New edition, 1831.

TABLE.

Names of Engines.	Area of fire grate in feet.	Area of *radient* surface in feet.	Area of *communicative* surface in feet.	Cubic feet of water evaporated per hour	Lbs. of coke required to evaporate a cubic foot of water.
Rocket . .	6.	20.	117.8	18.24	11.7
Sans Pareil	10.	15.7	74.6	24.	28.8
Novelty .	1.8	9.5	33.		
Old Engines	7.	11.5	29.75	15.92	18.34

In examining the above, we find a very important effect in the economy of fuel, produced by the Rocket over the old engines, in the proportion of 11.7 to 18.34, supposing the heating powers of coke and coal to be equal. The cause of this is very obvious, and is entirely attributable to the use of the tubes of small diameter, presenting such an area of surface to the water in the boiler. These tubes were used at the suggestion of Mr. Booth, treasurer to the Liverpool and Manchester Rail-way Company, and nothing, since the introduction of those engines, has given such an impulse to their improvement.

With a less area of fire grate than the old engines, the surface exposed to the radiant heat of the fire is as 20 : 11.5, and the surface exposed to the communicative power of the heated air and flame, as 117.8 : 29.75, nearly four times as great.

Nor is this the only difference; in the old engines, the *area* of the tube, (of 22 inches diameter,) for the passage of the flame and heated air to the chimney, was 380.13 inches; and of this large body of flame and air passing through the tube, only an extent of surface of 69.11 inches, was exposed to the water in the boiler. In the Rocket engine, the area of heated air and flame in 25 tubes, 3 inches each in diameter, was 176.7 inches, while the surface exposed was 235.6 inches.

It is not necessary, perhaps, to pursue the comparison further.

The economy of fuel which must result from the exposure of so much greater surface to the water, cannot fail to ensure a more perfect abstraction of the heat, and thus not only save the fuel, but prevent great part of the previous destruction of the chimney, by the intense heat of the *wasted* caloric.

The same remarks apply to the Sans Pareil of Mr. Hackworth, as to the old engine, though in a less degree. In the Rocket, the surface exposed to the radiant heat of the fire, compared with the area of fire grate, is as 3⅓ : 1, while in the Sans Pareil it is only 1½ : 1; the same proportion as in the old engines. In the Rocket, the surface exposed to the heated air and flame, compared with the area of fire grating, is as 19⅔ : 1; while in the Sans Pareil, the proportion is only 7½ : 1. The bulk of air passing through the tube of the latter, will, at its exit into the chimney, be 176.7 square inches, the exposed surface being 47.12, or, 25 : 1, nearly; while, as before stated, the bulk of air passing through the tubes of the Rocket, is 176.7 inches, or precisely that of the Sans Pareil, while the surface exposed, is 235.6 inches, or 1⅓ : 1. These will sufficiently account for the great difference in the economy of fuel between the two engines; the Rocket requiring only 11.7 lbs. to convert a cubic foot of water into steam, while the Sans Pareil required 28.8 lbs.

Some explanation is, perhaps, necessary, why the Sans Pareil should, in this respect, be more extravagant than the old engines, while the extent of surface, compared with the area of fire grate, is much greater, and therefore should exhibit a more economical result: and this explanation is the more necessary, as, though not appearing at first sight, it involves a principle of the greatest importance in the economy of those engines; and which, if not acted upon, would render the use of the tubes, however otherwise valuable, considerably less effective.

It will readily occur to any one, paying a little attention to the matter, that the system of tubes may be carried so far, as to reduce the temperature of the flame and heated air, nearly equal to that of the water in the boiler; in which case, when it reaches the chimney, it will be incapable, from its reduced temperature, of producing a sufficient draught of air through the fire grate. This would prevent all the advantages being taken of the refracting powers, which would otherwise result from the use of these tubes. It is stated, in another part of this work, that on the introduction of those engines, it was necessary to resort to the application of the waste steam thrown upwards into the chimney, to create a sufficient current of air through the fire; which was afterwards laid aside, or only partially used, when only slow rates of speed were required.

Mr. Hackworth had, it appears, in his engine, resorted to the use of this in a more forcible manner than before used, throwing it up as a jet, and which, when the engine moved at a rapid rate, and the steam thereby almost constantly issuing from the pipe, had a most powerful effect.

This, though effecting the object for which it was intended, being carried too far, partly in consequence of the rapid speed at which the engine was made to travel, was productive of another evil, which, though operating fatally so far as regarded that particular experiment, was capable of easy remedy.

The consequence was, that when the engine began to travel at the rate of 12 or 15 miles an hour, the draught was so great, that it actually threw the cinders out of the chimney with considerable force, producing a destruction of fuel enormously great, so much so, that the consumption was at least 692 lbs. per hour.

The area of fire grate of the Sans Pareil, was 10 feet; supposing that the area of the fire grate of the Rocket had been the same, the consumption of the latter engine, with its power of exhaustion, would only have been 361 lbs.; showing that the force of draught was so much greater in the Sans Pareil, as to consume nearly twice the quantity of fuel in the same time.

This will satisfactorily account for the apparent anomaly in the consumption of fuel with this engine, compared with that of the old engines, having a single tube; otherwise, though not likely to have come up to the Rocket in point of economy of fuel, we should have expected an effect considerably greater than in the old engines. The combustion of the fuel being so very rapid, and the abstracting surface so small, the heated air would pass off at a very high temperature; thus accounting for the loss of effect.

The knowledge of this fact,—or rather, availing ourselves of this power for the purpose of creating a draught in the chimney,—leads us to an inquiry of great interest. By an extension in the use of these tubes of small diameter, there is little doubt of our being able, (supposing we can force the necessary quantity of air through them,) to reduce the temperature of the heated air, before its exit into the chimney, nearly equal to that of the water in the boiler. This would be abstracting all the useful heat, and probably effecting all the economy of which the fuel is susceptible.

Perhaps it would not be adviseable to carry it quite so far as this; for when the temperatures become nearly equal, the abstraction of heat would be so slow, as to require a greater length of tube than it would be convenient to employ. We may, therefore, suppose, that in all cases, the temperature of heated air passing into the chimney, will be greater than that of the water in the boiler. The heat will, however, be insufficient, in engines of this kind, to cause a sufficient quantity of air to pass through the fire for the purpose of combustion; and it becomes a question, whether we should allow a portion of the heat to escape for that purpose, or, by contracting the exit of the escape of the steam from the cylinders into the chimney, to effect the same object.

Whether the last method is the most economical or not, though there is every reason to suppose it is, perhaps it is the only one with these engines that is suitable for their action upon rail-ways, especially for quick travelling. The performance of those engines depends entirely upon the quantity of steam they can raise in a given time; and when travelling at the rate of fifteen miles an hour, or upwards, the production of steam is required to be very rapid indeed:

the mode of producing a proper draught through the fire, by throwing the steam into the chimney, after its passage through the cylinders, is, perhaps, therefore, the best; as the quicker the engines travel, and when, consequently, the necessity for steam is the greatest, the then rapid and almost continuous exit of the steam into the chimney, increasing in proportion to the increased speed of the engine, produces, at the same time, a correspondingly greater quantity of steam.

In the "Rocket" engine, this mode of increasing the draught of the chimney, was but partially used; the steam was made to pass into the chimney, by two pipes, one from each cylinder, and the size of the aperture was not, therefore, sufficiently small to cause the steam to pass into the chimney with adequate force; still, in that engine, we find it only required 11.7 lbs. to evaporate a cubic foot of water,—36 per cent. less than with the old engines. We shall afterwards find, that this has been considerably more reduced in the engines lately made.

The "Novelty" engine is on a different principle from those previously considered, the necessary supply of air to the fire, being produced by a bellows. In this case, a chimney becomes unnecessary, and from the way in which the Novelty is constructed, the air was forced through the fire in a very condensed or compressed state. The area of fire grate being little more than one-third of that of the Rocket, and the surface exposed to the radiant action of the fire, less than one-half the temperature to which the fire was raised, must, of course, be considerably greater, to evaporate an equal quantity of water in the same time. The abstraction of heat would be probably more perfect in the Novelty, for the tube through which the flame and heated air passed in its exit to the atmosphere, was 36 feet in length, in one tube; whereas, in the Rocket, there was the same length, though subdivided into six tubes. It is, however, extremely questionable, whether one tube 36 feet long, or 6 tubes, each 6 feet long, *of the same sectional area*, are most preferable: the latter would, of course, give a much greater exposure of surface. The area of exit of the heated air, into the atmosphere, of the Rocket, was 25 times that of the Novelty; from which we may imagine the degree of compression necessary to force the same quantity of air through the fire; though we do not say, that to raise an equal quantity of steam, an equal quantity of air, in that highly compressed state, is necessary.

It was much to be regretted that the experiment with the Novelty could not be continued sufficiently long to ascertain the power of raising steam, by this method; the inquiry was of the utmost importance. Theoretically considered, we are of opinion, that this mode of generating steam, is more economical in point of fuel, than in engines, the combustion of the fire of which is kept up by the rarefication in the chimney; but there are practical objections to set against this, of which, the destruction of fire bars, and the power required to work the bellows, are not the least. We say theoretical, because, suppose two generators, the area of the grate bars, extent of radiant and communicative surface, are in both the same, except the area of exit pipe into the chimney, which with the generator worked by the bellows, is *one-half of that* by exhaustion of the chimney. If the same quantity of air pass through the grate bars in each, that with the bellows, will necessarily be of a more compressed state, to force the same quantity of heated air through the narrow exit; and this compressed state of the heated air will, of course, cause more of the caloric to be abstracted, than in the other case; for we suppose the temperature reduced to the same, in both cases, in the exit pipe. For if the heated air, in both cases, pass into a chimney of the same area, and equal to that of the exit pipe from the generator, on the exhaustion principle, the temperature of the heated air being supposed to be the same, in both cases, in the exit pipe, the heated air from the generator with the bellows will, therefore, have to expand itself in the chimney into twice its volume, which will, of course, reduce its temperature below that of the other; thus proving a more complete abstraction of the heat. The only question is, whether the disadvantage in practice, consequent upon the operation of such a principle, does not counterbalance any advantage gained in the economy of fuel; and this we must leave to experience to determine.

The question between the two modes, however, assumes a new character, since the application of the steam from the cylinder to create a current of air in the chimney; as in that case we can, by the use of a greater number of smaller tubes, reduce the temperature so low, until, if adviseable to do so, it is equal to that of the water in the boiler. And it then becomes a subject of inquiry, which of the two modes occasions a greater loss of power in obtaining the necessary current of air; the working of the bellows, in the one case, or the loss of power by the obstructed passage of the steam into the chimney, in the other.

It is, perhaps, necessary, after the above disquisition, to explain, so far as we are able, the cause of the failure of the Novelty engine at the Liverpool experiments, to show that it arose from no defect in the principle, but only in the construction of that engine. It will be seen by the sketches of this engine, that the flame and heated air, after leaving the fire, passed through the winding pipe of the horizontal generator. The generator was only 12 inches diameter, and there were three folds of the flue tube within it, in diameter from 4 inches at one end, to 3 inches at the other; very little space was, therefore, left between the flue tube and the top of the generator. The temperature of the flame, within this tube, when the engine was running at a quick rate, would be very great, especially where it left the upright generator; and the evolution of heat would therefore be so rapid, that the passage of steam out, would prevent the water from flowing along this horizontal generator; and the consequence was, that the flue tube got dry, and either collapsed with the heat and pressure, or gave way at the joint. This, it will be seen, however, arises from no defect of principle, and was easily remedied.

[*Rep. Pat. Inv.*

On the Law of Patents, as it exists in England.

We copy the following article from the London Journal of Arts and Sciences; as it contains many remarks applicable to the patent law of our own country, although particularly directed to that of England. From many of the defects of the English statute, and the practice under it, we are fortunately exempt; it is, however, universally acknowledged that the laws of the United States upon this subject are susceptible of great improvement.

We have been favoured with a copy of a small pamphlet, written by Mr. Richard Roberts, of Manchester, on the subject of our existing Patent Laws, with his views as to the best mode of amending them. This little work contains many valuable and judicious remarks upon this important subject; and as the pamphlet has only been *privately* circulated within the circle of the author's immediate friends, we have taken the liberty of making a few extracts, which we have no doubt will be acceptable to our readers.

It is acknowledged that mechanical inventions and improvements are beneficial to the public, and as men cannot be compelled to give their inventions or improvements to the public gratuitously, it is expedient to induce them to do so, by the hope of a due reward.

This reward is given in the least objectionable shape by granting to the inventor or improver, a patent of monopoly for a limited period; at so moderate a rate of charge as may put it in the power of such parties as are the most likely to invent or improve, to avail themselves of the monopoly.

A high rate of charge for a patent amounts in effect to a prohibition from taking one out, as it regards a large portion of those who are most likely to make discoveries: high charges, therefore, so far defeat the objects for which patents are granted, as they tend to check invention, and to cause to be withheld from the public, that which it is desirable the public should be possessed of.

No evil can arise from an increase in the number of patents taken out; because, if the discovery be worthless, the public is not injured; and if it be valuable, the greater the number of valuable discoveries made known, the more is the public benefitted.

Patentees, in general, are not likely to be over rewarded. Some few may be eminently successful; but, from the delay and expense of experiments, and from a disinclination in society to depart from established practices, a large proportion of them will either gain but little, or will even sustain loss. But, whether the patentee be rewarded or not, the public will be benefitted, if the invention patented be a valuable one.

Patents ought to be cheap; because the granting of a patent is merely recognising in an inventor, his property in his own invention for a limited period, on condition that he shall afterwards give the invention to the public; for, without his consent, no other person can avail himself of it.

Any sum charged for a patent, beyond its actual cost to the nation, has the effect of a tax on inventions; which must be paid, whether the thing taxed be saleable or not.

Whilst patents are expensive, the men most likely to make discoveries, (managers, foremen, and working mechanics,) are unable to obtain them: consequently, their inventions will, in but comparatively few instances, be made public; and, even in those instances, it will be by the inventors sacrificing to others a large portion of their own interest, in order to secure the remainder.

The expense of making experiments,'and of specifying inventions, is so great, as frequently to leave a man, after such expenditure, but little wherewith to obtain a patent: and if he begin by taking out an expensive patent, he may thereby be deprived of the means of making the requisite experiments and of specifying. In the former case, when his experiments precede the taking out of the patent, being through its high price incapacitated from securing a legal protection for his property, he is obliged to abandon the invention: whereas, under the same circumstances, a cheap patent might have put it into his power to benefit both himself and the public. In the latter case, when the taking out the patent precedes the experiments, the title of the patent gives to the public some knowledge of the invention; but, not being sufficiently matured, from want of means, it is rendered valueless both to the inventor and to the public. A dread of either of these results deters many persons from applying for patents.

Men of property who have had experience in the results of machinery, will not often be induced to risk their money in expensive patents; knowing, as they do, that before any profit can be realized, beyond the cost of experiments and of the patent, many years generally elapse; during which time there is considerable risk of the invention being superseded.

Many valuable machines are invented, which from various causes cannot be brought into profitable use for a great number of years. Few inventors of such machines can afford to pay a high price for patents.

A cautious man will generally take a considerable time, perhaps years, to decide whether or not he will risk the large sum now required for a patent; during which time the public loses the benefit of the invention.

Many things of a comparatively trifling nature are invented, which, were a cheap patent obtainable, would get into extensive use, and thereby benefit the public; but, when the inventor will not risk the large sum now required, the benefit of the invention is lost to the public, as well as to himself.

The early introduction of a useful invention or improvement is always of consequence to society, and therefore ought to be encouraged by the granting of cheap patents.

Patents, if cheap, would be taken out for many inventions, individually of little value; by which the patentee might possibly sustain loss, but the public would be benefitted. Besides, many of such inventions would either suggest a new idea, or by calling the attention of mechanics to what was looked upon as desirable, be the indirect cause of a further beneficial invention or improvement. This is proved to be the case in countries where patents are cheap, as an examination of the list of patents, especially in France, will testify.

By an increase in the number of patents obtained, greater publicity would be given to the most approved machines, or modes of operation, previously in use; for, as the greater number of inventions are for improvements in old machines, or modes of operating,—and it is requisite to describe much of the old machine, or mode, in order to explain the new invention,—the public would thus become acquainted with many mechanical combinations and processes of art, which probably were previously but little known.

By the encouragement which cheap patents would afford, many valuable inventions and discoveries would be published, through the patent office, which otherwise would either die with the inventor, or make their way to the public very slowly. The following inventions may be considered to be under this predicament.

The discovery of a principle, any practical application of which does not immediately present itself to the discoverer; or the means of making which application may not be then at his command.

The discovery of a mode of producing an original screw, of greater accuracy than can be produced by any known mode.

The discovery of a mode of dividing straight lines or circles, in a more simple and accurate manner than any hitherto known.

Discoveries of this nature, notwithstanding their importance to society, could seldom be profitable to a patentee; but still, if a patent were cheap, the discoverer would obtain one for the mere chance of remuneration; and at the same time to gratify his laudable ambition to be recorded as the inventor: and in this way, by the publication of the invention, society would be benefitted.

If a machine is intricate, and one machine, or one establishment with a given number of such machines, would be capable of supplying the demand of an extensive district; the inventor, rather than incur the risk involved in the obtaining of an expensive patent, with the view of remunerating himself by the grant of licenses to use the invention, will depend upon his power to keep the invention secret, and to benefit himself by the sale of the product of the machine.

There are many inventions to which the inventor, for various reasons connected with his regular business, cannot devote the time requisite for bringing them into operation; but he would risk a small sum for a patent if the invention afforded him reasonable hopes of remuneration by the sale of it.

If a man have a number of inventions, and if patents were cheap, he would take out a patent for each, giving to it a clear and definite title; whereas, under the present expense of patents, that cannot be afforded: and persons frequently wait till they have made several inventions, and then, that one patent may cover them all, they make out a very sweeping title. Thus the public is often deprived of the benefit of inventions for years.

An inventor often discovers, after maturing his invention, that the title is not correctly applicable to it; and in such cases, if patents were not expensive, a new patent would frequently be obtained with a title more appropriate.

The number of inventions imported would be more considerable if patents were cheap.

A patentee will often find it impossible to make a sufficient number of experiments to enable him to draw up a good and valid specification of his invention in time for enrolment to save his patent. In such a case, neglecting to give in any specification, he would, if he could obtain a patent for a small sum, take out a new one; unless in his former title he had already exposed too much of his invention.

Patents for Principles.

As the objects of granting patents are to benefit the public and to reward inventors, patents should be granted for all discoveries, of which the public had not any previous knowledge; for it is not reasonable to expect that persons will communicate their discoveries without some probability of being rewarded.

Many of the gentlemen who gave their evidence before the committee of the House of Commons, in the session, 1828, were of opinion that no patent ought to be granted for the discovery of a principle, unless the discoverer specified some mode of rendering the new principle useful to the public; and in that case, it may be presumed, they were of opinion that every application, of which the new principle should be found capable, ought to be secured to him, however inefficient his mode of applying it might be.

If such a plan is to be acted upon, it may require two distinct discoveries, the offspring of very different talent, to entitle to one patent. For instance,—a man may discover a new principle, yet, from the nature of his previous pursuits, he may be a very unlikely person to invent any apparatus, by which his new principle may be made useful to the public.

Before proceeding further, it may be proper to observe, that the word "principle," as applied to the arts, may be defined to mean any particular law or action of nature, by which two or more bodies influence each other, to produce some certain result; or, that particular kind of action by which any thing is characterized.

New principles may be discovered by persons who do not see any useful application of them; yet, as soon as they are made known, such application is quickly made by others.

If the discovery of the magnetic principle had not been communicated, the mariner's compass might never have been invented.

If the first person who discovered that steam is capable of exerting great expansive force had obtained a patent for that discovery, and thereby given publicity to the fact, it is probable that amongst the numbers who would have attempted to render such force available for useful purposes, some one would have been successful; and that the steam engine and many other inventions with which the force of steam is connected, would have been employed beneficially some centuries earlier.

Publication of Patents.

All specifications of patent inventions should be officially published at as early a period after they are lodged in the patent office as their nature will admit of, in some work to be established for that purpose, which should be published, say once or twice a month. The work might be designated "The Official Record of Patent Inventions."

The following reasons offer themselves in favour of such a mode of procedure:—

That patent inventions may be well advertised amongst the persons most interested in them.

As a trade may have a new direction given to it, or may be entirely destroyed by a new discovery or invention, extensive publication is desirable, that parties interested may regulate their future proceedings accordingly.

That parties interested may be well informed what the *claims* of a patentee are; and thus have an opportunity to set his patent aside if he be not fairly entitled to it.

From the claims of a patentee being extensively known, infringments would be more likely to be detected.

Much time would be saved which is at present devoted to the prosecution of supposed new inventions, but which have before been patented. There would also then be fewer instances than occur at present, of two or three patents being granted, at nearly the same time, for the same object.

Persons requiring office copies of specifications, for legal or other purposes, would be spared the great expense which is at present incurred; and much valuable time would be saved which is now spent in going to the office to examine specifications.

That patentees may not be injured by the destruction of their specifications, by fire or otherwise.

In specifying improvements it is generally necessary to specify the thing improved; consequently the readers of the "Official Record," would be made acquainted with the old machines, or other matters, as well as with the improvements.

Defective Specifications.

Much has been said before the Committee of the House of Commons, about defective specifications being lodged by patentees, who were desirous of concealing from the public the real nature of their discoveries.

With respect to *mechanical* inventions it does not seem probable that many persons will attempt such concealment, since the invention is of necessity exposed by the sale of the first machine.

In *chemical* discoveries, the case may be different; and if some mode of inducing a patentee to amend his defective specification could be devised, without introducing a greater evil than now exists from an occasional defective specification, perhaps it would be desirable to adopt it But nothing would tend more to put a patentee on his guard against making a defective specification, of either a mechanical invention or chemical discovery, than the knowledge, that his own workmen or others may become aware of, and expose those defects, whenever his specification is published in the manner recommended.

On the comparative durability of Cast and Wrought Iron, when used on Rail-roads. Extracted from the new edition of Wood's Treatise on Rail-roads.

We now come to the question of comparative durability between cast and malleable iron rails. The introduction of the latter being comparatively recent, the opportunity to subject them to the test of experiment, has not existed sufficiently long to produce any very conclusive decision from that source: the opportunities of doing so, are also not numerous; and many people are more disposed to concur in, and yield to, the general or current opinion, than either to wait the result, or submit to the tedious operation of experiment. In this case, also, no experiment can be decisive unless acted upon for a number of years: we are, therefore, almost obliged to act upon speculative opinion, until sufficient time has elapsed to produce conclusive evidence in favour of either mode.

Independent of economical considerations with respect to the durability of wrought iron rails, their safety, compared with cast iron upon public lines of road, has already almost produced a general concurrence in their favour: and therefore, perhaps, the question of durability becomes of less importance. Still, as in some cases, where rapidity of transit is not necessary, relative economy may become an object; we shall therefore adduce such as our experience enables us, of the comparative durability of cast and wrought iron.

Experiments are going on at present, where both kinds of rails, accurately weighed are laid down, and subjected to the passage of the same quantity of traffic over them: the result of these, so far as they have gone, are in favour of wrought iron. In the operation of making the cast iron rails, the surface is partially case-hardened in the casting: this may be seen in all cast iron rails extending to a certain depth from the surface; any experiment showing the comparative wear, must, therefore, be continued until after the outer hardened surface be worn through; and it is presumed that sufficient time has not yet elapsed to furnish this. We have therefore been obliged to reject the data founded on this mode of experimenting, and shall give the result of a different sort of test, more severe, and which, it is trusted, will be deemed sufficiently approximate to justify its presentation to the reader.

Upon the Killingworth rail-way, we had originally common cast iron wheels upon the locomotive engines; about four years ago we adopted wrought iron tires; now, as we have in this way the relative wear of cast and wrought iron upon the wheels which run upon the rails; and as the nature of the action will operate nearly alike, whether upon the surface of the rails, or of the wheels, we shall by that means have a pretty near approximation to the relative wear upon the rails. In this way, we have a considerably more severe test; as, if we take the quantity of traffic equal to 2000 tons passing along the rail-way daily, and suppose the carriages to convey 3 tons each, with 3 feet wheels, the relative wear of the wheels and rails are as 53 : 1 nearly.

The average wear of the cast iron wheels was above ½ inch in 9 months; and with the wrought iron tire, the wear of one pair of wheels has been ¼ inch in 3 years, and with three other engines, ¼ inch in 12 months; making the wear at least as 5 to 1 in favour of wrought iron.* The actual wear of the rails will not be to the same extent as this, as the engine wheels sometimes slip round, or slide upon the rails in bad weather. The wear of the wheels of the common carriages will not be so much for the same reasons; but although it should be observed, that from this we ought not to deduce the actual duration of wrought iron rails, as, their surfaces being narrower than the wheels, the wear will be, perhaps, more than proportionably greater; yet the relative wear should, however, remain the same.

The very great difference of wear in the wheels, proves, beyond any doubt, that if rails of the proper degree of strength be used, the durability must be decidedly in favour of wrought iron rails; and we have before observed that practice has shown, that in rails properly manufactured, none of the exfoliation, lamination, or oxidation originally dreaded, exists.

The next inquiry is, whether the resistance is greater upon wrought than upon cast iron rails. As in the case of the cast iron, when first introduced, the wrought iron rails were made far too slight; and observation showed that to a certain extent, the resistance appeared greater than upon cast iron; and this, as may be supposed, was owing to the bending.

To ascertain if such was the fact, to what extent, and to what strain they could be subjected without increasing the resistance, the following experiments were made.

Two lengths of rails were laid down upon balks of wood, one of cast, and the other of malleable iron, both of which were taken off the rail-way in their working, and brightened state. They were laid down close to each other, upon the same balks, and a pair of wheels resting on one could be readily lifted upon the other: two wheels joined together by an axle, and taken from one of the carriages in use, were then placed upon one of the lengths, and loaded on the lower side of the rim with weights, that could be varied at pleasure: the wheels thus unequally loaded, became like a pendulum, by the centre of gravity being thrown near the periphery on one side; and they would of course only remain at rest, when the line of gravity passed through the centre of the axle joining the two wheels, and that point of the periphery resting on the rails: the wheels were then rolled along the rails, until the centre of gravity was several inches beyond the point of bearing, and when let go, it of course vibrated backwards and forwards, until the resistance of the periphery upon the rails brought it to rest.

---

* The following is a memorandum of the duration of wrought and cast iron rails on the Stockton and Darlington rail-way.

Malleable iron rails, 15 feet long, over which locomotive engines pass, weighing from 8 to 11 tons. Wagons and their loads, 4 tons each.

86,000 tons passed over in a year, exclusive of engines and wagons.

Weight of rail, 1 cwt. 26½ lbs.

Loss of weight in 12 months, 8 oz.

Cast iron rails, 4 feet long, over which wagons only pass, weighing 4 tons each when loaded.

86,000 tons passed over in a year, exclusive of wagons.

Weight of rail, 63 lbs.

Loss of weight in 12 months, 8 oz.

The loss of weight in malleable iron rails, when wagons ONLY passed over, was, in the same period, 8 ounces for 15 feet length—the same quantity of goods, 86,000 tons.

This mode of experimenting was preferred to trying the relative resistance by carriages; as, in this way, there was no action except that of rolling; and by lifting the wheels alternately from one kind of rail to the other, without altering the weight, the comparison became very delicate. A scale was used to measure the extent of each vibration from the centre, and the observations made by a telescope: the number of oscillations were thus counted, while the extent of the vibrations were diminished each inch. Thus, at the commencement, the extent of the vibrations from the point of rest was 5 inches; and the wheels made 56 vibrations before this was diminished an inch, or until the extent of vibrations from the centre was 4 inches. The cast iron rails were 3 feet 9 inches long, and weighed 56 lbs.; section shown in Fig. III. Plate II. The wrought iron rails weighed 28 lbs. per yard, the bearings 3 feet apart; section same as experiment II. on the strength of rails.

EXPERIMENT I. EXPERIMENT II.

Extent of Vibrations.	Weight of wheels, &c. 10 cwt.				Weight of wheels, &c. 20 cwt.			
	Cast iron Rails.		Wrought iron Rails.		Cast iron Rails.		Wrought iron Rails.	
	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.
in. in.								
5 to 4	56	62	54	64	52	50	52	52
4 to 3	74	78	68	80	64	70	64	66
3 to 2	88	22	84	100	84	82	92	86
2 to 1	87	86	98	84	99	110	142	150

	EXPERIMENT III.					EXPERIMENT IV.					
	Weight of wheels, &c. 30 cwt.					Weight of wheels, &c. 40 cwt.					
	Cast iron Rails.		Wrought iron Rails.			Cast Iron Rails.		Wrought iron Rails.			
Extent of Vibrations.	No. of vib.	Wedged.	No. of vib.	No. of vib.	Wedged.	No. of vib.	Wedged.	No. of vib.	No. of vib.	Wedged.	Wedged.
		No. of vib.			No. of vib.		No. of vib.			No. of vib.	No. of vib.
in. in.											
7 to 6	—	—	—	—	—	28	30	24	26	31	32
6 to 5	—	—	—	—	—	32	34	28	28	32	32
5 to 4	54	46	54	54	50	42	36	38	38	35	35
4 to 3	66	56	70	66	68	44	48	44	46	43	45
3 to 2	82	78	90	94	90	48	46	56	55	50	48
2 to 1	94	90	116	124	114	52	52	84	82	63	66

These experiments will show that the resistance was the same with malleable and cast iron rails, until the incumbent weight reached 30 cwt.; with 40 cwt. the number of vibrations from 7 inches to 3 inches, in cast iron, was 146; while upon wrought iron, it was 134 and 138 respectively; showing a trifling increase of resistance with that weight. The rails were then wedged up on the under side to prevent them from bending, when the number of vibrations of cast iron was 148; showing that scarcely any resistance was owing to the want of stiffness. With the wrought iron, the wedging had an increase of effect, and brought up the resistance nearly equal to that of cast iron; and thus proving, that when no bending takes place in the wrought iron, the resistance is precisely the same as with cast iron.

We, however, find by these experiments, that the rails of wrought iron, upon which these experiments were made, were only sufficient for carriages of four wheels, weighing three tons. The deflection with 30 cwt. was .032 inch, with 40 cwt. .043 inch; so that we find it will not be adviseable to use rails, the deflection of which, when loaded, amounts to .032 inch, especially when the rails are laid down of this strength; as when they become worn, the deflection being greater, an increase of resistance will take place. With carriages mounted upon springs, which yield to all the inequalities, and want of parallelism of the road, we may suppose the whole weight of the carriage divided equally upon the four wheels. But with carriages without springs, as before stated, the weight of the carriage very frequently rests upon two wheels only: and in practice, therefore, we must, with these kind of carriages, suppose the whole weight acting upon two wheels.

To ensure, therefore, no increase of resistance in the use of wrought iron rails, their rigidity should be such, as that, by carriages with springs, one-fourth; and by carriages without springs, one-half of the *weight will not cause a deflection in the middle of the rail equal to .032 parts of an inch.*

And considering that, in the experiment, the weights were applied carefully upon the rail; and that in practice, the weight, especially in carriages without springs, will be occasionally imposed with great abruptness, it will always be adviseable, independent of making proper allowance for wear, to adopt rails of more than sufficient rigidity to resist any injurious deflection by the weight of the carriages. The tables of experiments on the rigidity of different sections of rails, will be useful in determining the proper strength for practice; both for single lengths, and with rails of several compartments in one length.

The experiments on the comparative resistance of cast and malleable iron rails, were made with the surfaces of the rails quite dry, and free from dust: to ascertain the increase of resistance by the occurrence of any extraneous matter on the rails, the surfaces were watered pretty freely. The number of vibrations, before attaining a state of rest when dry, was 540 and 570, respectively; and when watered, 375. Upon wrought iron rails, when dry, with a less extent of vibration, the number of oscillations was 404 and 412; while, when chalked, the number was 230. With cast iron, when oiled, under the same circumstances, the number was 290; and when still more copiously oiled, the number was reduced to 244.

The result of these experiments is, therefore, that no increase of resistance takes place upon wrought iron rails; and that the resistance is a minimum, when the rails are quite dry and free from any extraneous matter. [*Rep. Pat. Inv.*

On the tempering of Metallic Wires and springs for Chronometers, Watches, Musical Instruments, &c.

To the Editors of the London Journal of Arts, &c.

Gentlemen,—A course of experiments in which I have lately engaged myself, has drawn my attention to the subject of the "*spirit*," as workmen technically call it, of metallic springs. The connexion of this subject with various important branches of our arts may claim for it a small space of your valuable publication. In respect of the more important interests of navigation, as well as of numerous minor purposes, a few practical observations may prove serviceable, by extending the knowledge of the ramifications of science. Springs are made perfectly well for different objects, so far as the manufacturer is concerned,—but a more general information as to their different temper, and the principles of such difference may tend to the more correct and perfect adaptation of elastic substances to the required end of the workmen who use them.

I am indebted for much of the following information to an old French memoir, originally published in 1774, by M. Le Roy, pere, the celebrated watchmaker of Louis XV. Certain experiments in acoustics have supplied me with proofs of his correctness, and with some generally useful memoranda.

A bar of steel or iron, after being sufficiently heated, or subjected to the action of fire, becomes successively yellow, violet, blue, gray and white. The variations in intensity of these colours will partly depend upon the state and quality of the metal operated upon. Although philosophers are agreed that all hard bodies are elastic, yet hardness does not constitute *the measure of elasticity*, for a glass ball is much more elastic than an equal globe of cast iron; but their difference of hardness is by no means proportioned to that of their elasticity. A Damascene, or Moorish sword blade, is more springy or elastic than another, which shall, notwithstanding, make an impression upon the edge of the former. Now, this difference arises from the varied mode of tempering the respective blades. The steel or iron, after each transition above noticed, is said by the French to become *revenu*.

M. Le Roy informs us that he took three wires of common steel, to which he suspended weights, and put them in pendulous motion. They did not maintain their vibrations beyond seven minutes. He then tempered them to the fourth or gray state; in this stage of *revenu* the same wires maintained the vibrations of their masses during the space of 50 minutes. A wire of cast steel, which maintained the vibrations of its suspended weight for 10 minutes, continued them after it had passed to full blue, (*gros bleu*,) an hour longer. From Dr. Thompson's published tables of Cohesion, we learn that the power, or force of cohesion of bar iron, is to that of cast iron nearly as 75 : 50; for to tear asunder rods of each species, an inch square at the base, it required 74,500 lbs. avoirdupois, to destroy the cohesion of the particles of the bar iron rod, and 50,100 lbs. to effect the breaking of the cast iron rod. The elasticity or *spirit* of tempered steel springs appears, therefore, to be in an inverse ratio to their power of cohesion. An untempered wire of a harpsichord, maintained its vibrations for 14 minutes; after being tempered to gray-white, it maintained its suspended weight in motion nearly an hour. A wire of cast steel was tempered to *gros bleu* and then was diminished, (i. e. untempered,) and polished, in which state it vibrated only 17 minutes, but upon the *revenu à gros bleu*, it vibrated 67 minutes. These general facts serve to show the great advantage of understanding the variations of tempering, as affecting the elasticity of springs, and their consequent fitness for any required purpose. Our author appears to have applied his knowledge to the formation of the best chronometer work of the period, in which art he gained a high reputation.

But mere soft metallic wires and springs without any temper, will not vibrate well, nor maintain for any great length of time a suspended pendulum bob in motion. A copper wire is unsuited for these purposes; a brass wire is suitable in proportion to the quantity of zinc in its composition, so that it does not exceed one-half; the usual proportion is four parts of copper to one of zinc. About two years after the publication, by M. Le Roy, of his experiments, Count

Bruhl, the ambassador from the court of Dresden to St. James's, and M. Phillidor, had several piano fortes made, and strung with wires tempered *gros bleu;* they were universally acknowledged by amateurs, and the Royal Academy of Paris, to be superior in tone to instruments chorded with the usual steel wire. The progress which is making in the general application of scientific principles to our various branches of manufacture, induces me to hope that these few reminiscences may prove useful to some of our artists and operatives.

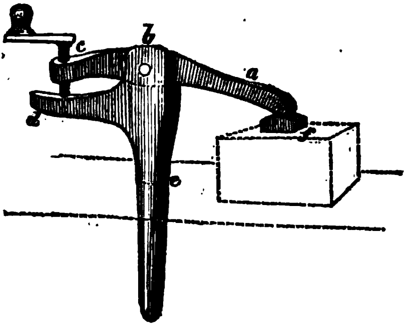
[*Lond. Jour.*

Hold-fast for Carpenters.

From the Transactions of the Society of Arts.

The common carpenter's hold-fast is a round bar of iron, thickening a little upward, and bent at the upper end almost into a right angle and flattened. An oblique hole is bored in the bench; and if a piece of wood, or any other article is wanted to be secured, it is placed under the hold-fast, and a few strokes of a mallet are sufficient to make it bite firmly. In order to loosen it, nothing more is necessary than a blow of a hammer applied at the back, or lower end of the bar.

Dungey's Hold-fast.



In Mr. Dungey's hold-fast, the jaw, *a,* instead of being one piece with the rest of the bar, is moveable on the axis *b,* and is prolonged backwards. In this latter part is a hole for the reception of a cranked screw, *c,* which bears on a projection, *d,* of the main bar: *e* is the hole in the bench, and *f* is a flat square piece fixed by a loose joint to the jaw *a,* and therefore capable of bearing by its whole surface on any piece of work placed under it. By turning the screw *c* in one direction the work is held fast, and by turning in the other direction it is released. It is considered as likely to be of service to coachmakers, carvers, and chair and cabinet makers, as the pressure of it is under perfect regulation, and it is not liable to bruise the work which it is employed to hold.

Meteorological Observations for September, 1831.

Moon.	Days.	Therm.		Barometer.		Dew point	Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2 P.M.		Direction.	Force.		
				Inches	Inches.				Inches.	
	1	63°	76°	29.90	29.90	62	S.	Breeze.		Clear—cloudy.
	2	68	76	.80	.80	67	S.	Calm.		Overcast—cloudy.
	3	68	77	.80	.88	67	SW. S.	Moderate.	.7	Cloudy day. Sh'r in night
	4	63	67	.86	.86	54	NE.	Breeze.		Cloudy—drizzling.
	5	63	75	.86	.86	55	W.	Moderate.		Cloudy—clear.
⊗	6	62	75	.91	.93	61	NW.	Breeze.		Clear—overcast.
	7	61	76	30.00	30.00	57	SW.	Calm.		Clear—overcast.
	8	67	76	29.90	29.87	64	SW.	Breeze.		Cloudy—overcast.
	9	67	76	.74	.74	64	NW.	Moderate.		Cloudy—overcast.
	10	69	83	.75	.75	65	SW. W.	Calm.		Fog—clear.
	11	71	82	.80	.80	64	W. SW.	Breeze.		Clear day. Shwr in night.
	12	62	72	30.00	.98	46	NW.	do.	.5	Clear day.
☽	13	56	79	.03	30.04	50	W.	Moderate.		Clear day.
	14	56	70	29.95	29.92	54	S.	do.		Cloudy day.
	15	65	70	.86	.77	61	SE.	do.	.30	Cloudy—rain.
	16	61	62	.85	.95	59	NW.	do.		Cloudy—rain. Rain night.
	17	56	63	30.00	30.02	52	N.	do.	.30	Cloudy—clear.
	18	47	63	.07	.05	40	NE.	do.		Clear day.
	19	47	69	29.98	29.95	45	NW. SW.	do.		Clear—overcast.
	20	49	73	.86	.83	50	W.	do.		Cloudy—clear.
⊙	21	59	69	.83	.90	54	NE.	do.		Cloudy day.
	22	59	75	.93	.89	57	NE. SE.	Breeze.		Cl'dy—overcast. Rain n't
	23	68	69	.76	.70	67	S. NW.	Moderate.	.74	Showry—cloudy.
	24	55	66	.80	.80	45	NW. W.	do.		Clear day.
	25	55	69	.90	.86	55	NW. SW.	do.		Cl'r: cld'y: rain: rain n't.
	26	63	71	.74	.74	62	NE.	do.	.62	Cloudy day.—rain night.
	27	61	71	.55	.55	60	NW. SW.	Breeze.	2.85	Cloudy day.
☾	28	51	63	.60	.70	45	W.	Blustering.		Cloudy—clear.
	29	49	64	.75	.72	49	W.	Moderate.		Clear—cloudy.
	30	44	63	.92	.94	42	NW. W.	do.		Clear day.
	Mean	59.56	71.10	29.86	29.86	56.1			4.93	

	Thermometer.	Barometer.
Maximum height during the month,	83. on 10th.	30.07 on 18th.
Minimum do. . .	44. on 30th.	29.55 on 27th.
Mean do. . .	65.80 . . .	29.86

Note to Subscribers.

Our subscribers are informed, that the delay in this number of the Journal, has been caused by the destruction of part of the printed sheets, in a fire which occurred at the printing office of the Journal.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

NOVEMBER, 1831.

Propositions and Suggestions on the means of obviating or lessening the accidents incident to Navigation by Steam. By JOHN S. WILLIAMS, *Engineer.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—I have with much satisfaction read the remarks of Mr. Earle, (vol. vii. p. 154,) on the causes of some explosions in steam boilers. I fully believe the reasons he assigns, and the conclusions he arrives at, to be correct. Apprehending, however, that he has been too brief respecting preventives, I shall add a few paragraphs upon this subject; in doing which I shall not confine myself to any one particular class of accidents to which navigation by steam is liable.

Upon the western waters, steam boats have, at an average, from 4 to 5 boilers each, of 36 inches in diameter, and 18 feet long, with two flues of 13 inches in diameter, running from end to end of each boiler. These boilers are placed upon a horizontal bed occupying a breadth of from 12 to 15 feet across the fore part of the boat.

A very large proportion of the explosions of boilers, say five-sixths, are occasioned by the collapsing of the flues, and not, as is commonly reported, by the bursting of the boiler proper. The reason of this appears to be that metal of the strength to resist a rent is by no means adequate to prevent a collapse. The ability of flues to sustain the pressure of the steam, is the mere stiffness of the metal in conjunction with the perfect regularity with which the arch or circular shape of the flue is constructed and maintained. Should one diameter of a flue exceed another only by one inch, when the steam is up to 100 pounds upon the square inch, there would, in a flue 18 feet long, be 21,600 pounds of force applied directly to produce a collapse. There is little danger attending the collapse of a good flue, save from the rending of the metal from the head of the boiler, which is very apt to take place. Flues, however, have collapsed without leaking a drop, and consequently without further damage than the loss of the flue itself; this has happened when the boiler heads have been made of wrought iron, but perhaps never with cast heads, which ought to be rejected. Cast heads are apt to crack by frequent heatings, and when they give way, they deal destruction fore and aft.

I agree with Mr. Earle in the idea that it injures boilers and flues to be overheated, even if they should not explode at the time. I am fully persuaded that metal overheated under a high pressure is never again so fit to bear pressure either as a boiler or flue. Perhaps the reason may be that, to lower the temperature of iron a little, and suddenly, under a high pressure, operates upon the structure of the metal the same as to cool it to a greater degree under a less pressure. Not only ought the overheating of boilers and flues to be guarded against with all possible care on this account, but because the overheating is very likely to generate a quantity of highly rarified steam, to the destruction of boiler, boat, and crew, by a sudden explosion. The most common causes of the overheating of boilers and flues are, undoubtedly, carelessness, or want of skill, in the engineer, who may let the water get too low; an unnoticed failure of the force pump to perform its duty; the rolling of the boat in a heavy sea; or any thing else that causes the boat to tilt, such as the running of passengers to the side next to an approximate town or shore, combined with the discharge and reception of freight, and the reception of wood at the same side. This occasions the water to flow through the connexions from the higher boilers to the lower, and this again increases the bias, and draws more water after it. The best height of water for generating steam, is when the flues are kept just covered by it, and no more. Hence some engineers run the water very close, not allowing it to rise more than one or two inches over the flues. It is then plain that a small tilt or bias in the boat will lay the flues in one, or more, of the boilers, instantly bare, which soon becomes much heated, and generates a quantity of highly elastic steam upon the boat being restored to its level, so as to cause the water to take its proper position. In this situation, should the heated flue have the least irregular shape, so as to *favour* such a circumstance, it will collapse vertically, because the heated part of the flue is robbed, by the heat, of its stiffness, which is its only means of supporting its burthen. But should a flue thus partially heated, have been constructed perfectly cylindrical, I presume the collapse will then be horizontal, inasmuch as heating the upper part necessarily lengthens the horizontal diameter. Unless the boilers be uncommonly strong, the steam thus suddenly generated, must get vent either by valves or by an explosion; in many instances, by collapse only, but most destructively by bursting.

I now proceed to give some ideas as to the most likely means of preventing such occurrences. In order to prevent the danger attending the tilting or sidelong position into which boats will necessarily be thrown at times, it is suggested that the boilers be unconnected, and that each be supplied by a force pump separately. But should this be thought troublesome and expensive, let the pipe from the force pump have a branch running to each boiler separately; let each of these boilers be furnished with a valve and stop cock, the valve opening towards the boiler; and let the steam pipes also, which lead out of each boiler, be furnished with a valve opening towards the cylinder. It is evident that in a boat where the boilers were thus connected, or rather, thus disconnected, no water could flow from the higher towards the lower boilers, were the boat tilted ever so much. In this case, the flues would be relieved of much of their present exposure to heat, because the water in each boiler must waste by evaporation, not flow out, before its flues would be laid bare. Thus, even were no water pumped in, twenty minutes or half an hour might be spent in this situation, without exposing the flues, under the calculation that the perpendicular waste of water is about an inch in ten minutes while running. Further; boilers thus situated would be less dangerous, not only because the flues and sides would be less exposed to heat, but because, even supposing them heated, they would not be subjected to a sudden reflux of water from the other boilers upon the boat being restored to her proper trim. It is conceded that should the force pumps play while the boat is out of trim the water would be thrown into the lower boilers, and after the trim should be restored, into the others, until all would be on a level; but the introduction of stop cocks into the pipes furnishes the means of regulating the supply of water in any position. By making a hole in one side of these pipes, and introducing three-way-cocks, means are also obtained of drawing off the water from any one, or all, of the boilers, separately, if the supply pipes are lower than the boilers.

In the steam pipe of each boiler, by which it is connected to the common steam pipe, a valve should be placed, opening upwards. Each boiler would thus give its supply of steam independently of the others, and if from any accident steam ceased to be generated in one, its valve would be closed by the pressure of steam from the other boilers, and all waste be thus prevented.

The valves above mentioned to be placed in the steam pipes would, by no means, obstruct the passage of the steam from the boilers to the cylinder, neither would they prevent the perfect equilibrium of the steam to the creation of any danger. The steam in each boiler would maintain the same pressure as the steam in the common pipe or cylinder, or be below that pressure. Let the safety valve be placed on the common pipe where the steam from all the boilers unites. In this case any one boiler which might be suddenly surcharged with steam would open and occupy the whole capacity of the safety valve for its own relief, which would thus be more effectual. Again; under this disposition of boilers, a surcharge in one would not occasion the collapse of a weak or misshapen flue in another, nor another boiler, that might be deficient, to burst. On a boat with five boilers and ten flues, connected in the common way, the chances are against the bursting or collapsing taking place in the same boiler in which the cause of the accident occurs; but under this arrangement, both must take place in one, or the accident will not happen, by reason of the surcharged boiler being sufficient to bear the pressure. It seems to me that this would greatly lessen the number of accidents. Under the present arrangement, when one flue or boiler gives way, all the power of every boiler is exerted through the connexions, and acts upon the deficient one to render the destruction complete; but under the arrangement here proposed, the power of one boiler only would be exerted upon the boat, its contents, and crew. This is certainly an important consideration, which would hold good in all cases of collapse, and seldom fail in cases of bursting, were the boilers properly secured in their places. But further, there would another advantage attend this proposed arrangement, which, though mentioned last; may be equally worthy of consideration with the preceding. It is this—that in case of an accident, by collapse or by bursting, if the whole bed should not be deranged, not a stroke of the piston would be lost. The remainder of the boilers would not cease to drive the engine, although with diminished power. The vessel would still be under the command of the pilot, and enable him to pursue his voyage or to run into port, where medical aid and other comforts, might be obtained for the wounded. This circumstance alone would take off much of the appalling aspect of such occurrences. For part of a crew to be killed, and others crippled, and, withal, for the boat under these, the most distressing, circumstances, to be completely deprived of power, is such a picture as I can hardly bear to contemplate when I draw it; neither would it be drawn did I not believe myself to be urging measures to lessen the frequency of its occurrence as well as the horror of its features. It is true that after such an accident has occurred to one of the boilers, and, of course, all the pressure in it taken off, all the water from the force pump would be thrown into this deficient boiler. But in the course of 15 or 20 minutes, before any danger from running without a supply would occur, the engineer or some one, might turn the stop cock leading into that boiler, and force the supply into the others, when every thing would go on as before the accident, with the loss of only so much power as had been obtained from the injured boiler.

While on the subject of lessening the force of such accidents, in the destruction occasioned by them, permit me to recommend what has been repeatedly urged by others, that an almost impregnable partition be constructed to defend the lives of those passengers who shall keep their proper places. A strong bulk-head placed aft of the flues, would dissipate the force of the steam in the fire bed and through the sound flues, if the discharge was backward, as the contents of one only would have to be guarded against; and chimneys well secured, and of nearly equal strength with the boilers, would be likely to turn all the contents of one boiler upward. In this way the life of many a fireman, as well as those of passengers, would be saved.

As explosions by bursting are the more destructive, so those by collapses are the more frequent; thus by them, many lives and much property are lost. Every precaution that ingenuity can devise, or discretion suggest, ought to be adopted to prevent their occurrence, and lessen their destructive effects when they do occur. Let, then, the strength of metal be increased, or the diameters of both boilers and flues be diminished, and their numbers increased, to accomplish the same ends. Although our means of precaution may be expensive or troublesome, (which is not admitted to be the fact,) yet the increased confidence and business of that mode of conveyance, would amply repay the prudent, as well for a small expense, as for the additional care in keeping their boilers clear of earthy and saline matter, which tends greatly to their decay, if not to their sudden and total destruction.

After having suggested several improvements in supplying boilers with the common pump, allow me to take a brief notice of a patent obtained by me, for what I believe to be an improved method of supplying the boilers of steam engines with water. I mention it with hesitancy, although I have much confidence in its utility, but am not now so situated as to put it into operation myself; should any one, however, conceive it worth an experiment, and apply to me, post paid, for a right to use it, I hope to convince him that a sordid love of gain forms no part of my composition. This invention was published by you, with a cut, in March last, vol. vii. p. 183. A common boiler would require the water chamber, B, [see the cut,] to be from 6 to 9 inches cubic; and the reservoir might be nothing more than a pipe or apartment kept supplied by a fount from the condenser, the hot well, or the cold water pump. The whole structure might be attached to the main head, and with it removed, cleaned, inspected, or repaired, with the greatest ease and convenience. The cut shows the principle in the easiest way it could be presented to the eye, but not the most convenient mode of applying it to the machinery. Instead of the cocks, E and F, a sliding escapement, a four-way-cock, or a double conic valve, will be easy to construct, and readily connected with the motion of the engine. A wooden float in the chamber B, would prevent condensation by separating the steam from the water. The apparatus can be attached to any part of, and all sorts of boilers, or connected with them by pipes, provided the necessary levels are preserved.

I propose that one apparatus should be attached to each boiler in boats, with valves in the steam pipes, as above recommended. To the advantages gained by the above arrangement, with the common force pump, I presume the following will be added; my apparatus will require no stuffing, and have fewer wearing parts; it would introduce no greasy and linty substances into the boilers, which, combining with earthy matter, sometimes form blackberries, (so called,) which burn to the bottom; it requires less power to keep it going, and by a small discharge of steam at every operation, would notify its proper action; it will keep the water in the boilers always at the same height, by discharging more than the waste when the water is too low, and less when it is too high in the boiler, if accident or design should make it so. Thus by its own operations, would it find the proper height for the water, and steadily maintain it at that height as long as the operation goes on, and the supply kept up. And, lastly, should the boat lie ever so sidelong, it would keep in every boiler its proper supply of water.

But, after all, accidents will occur, under the management of unskilful and careless engineers; boat owners are frequently imposed upon by vagrants under that name. The remarks of your correspondent, R. D. H. published in vol. vii. p. 289, are, in the main, very judicious, and I hope he will succeed in his experiments. Safety valves are certainly a security, if properly constructed, and left to operate freely; but they are often tied down, and are thus rendered useless. I lately passed a boat in which I know that the engineer had been in the constant practice of tying his safety valve down under the power of a double lever. I passed by it in another boat, and, as might be expected, death and destruction had visited the spot. I could enlarge, but charity throws a veil over the past, and seeks a future remedy. Let those who are competent devise it, and those who have power and means carry it into effect. Let there be a Board of Inquiry to examine the moral standing and skill of engineers and pilots; let boilers be tested, let large safety valves be placed out of the reach of all on board, let the causes of accidents be inquired into, or let any method, in any way promising, be adopted and pursued that might tend to lessen the evil, and increase the chances of escape.

Another class of accidents to which steam boats are liable is that of fire. Is it not almost incredible that a vessel whose very propelling power arises from fire, and in which a profuse application is made of oil, which is built of the most light and combustible materials, exposed to numberless sparks, and the constant heat of a furnace, should be seldom or never guarded against consumption by fire? Would not a force pump, worked by the engine, supplied with hose, be a necessary appendage to them?

Boats running into and sinking each other, and boats burned to the water's edge in a few minutes, boilers bursting, and flues collapsing, together with the attendant death and destruction, make up a considerable amount of human ills, which call loudly upon the powerful and the humane for their exertions to arrest. Power by steam, managed as it might be, would not only be the easiest and cheapest mode of transit for goods and passengers, but the safest also; but for the want of skill or attention, our use of it has increased greatly beyond our provisions for rendering it so.

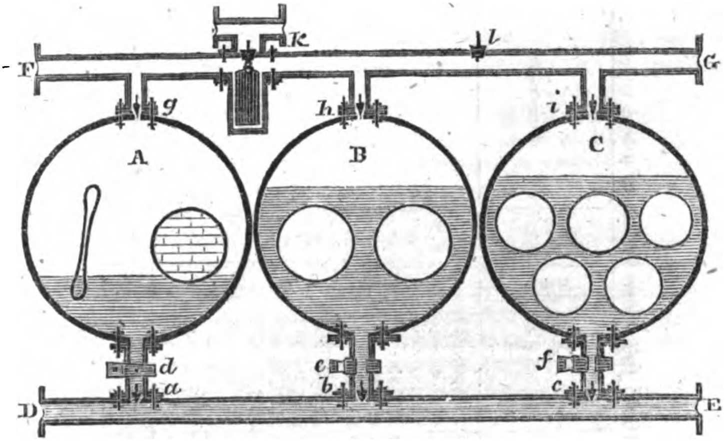
Being deeply impressed with the importance of my subject, it has been extended to a greater length than I had anticipated; if I have been tedious, let the motive plead my excuse with your readers.

Yours respectfully,

Jno. S. Williams.

Washington, Mason county, Ky. Sept. 12, 1831.

Notes and references explanatory of the accompanying drawing, and Illustrative of the mode of connecting boilers recommended in the foregoing essay.



A B C, sections of three boilers placed at or near a level.

D E, supply pipes. *a b c*, valves opening from the supply pipe towards the boilers. *d e f*, stop cocks between said valves and the boilers, which by being made three-way-cocks, may serve to drain the boilers.

F G, steam pipes leading from the boilers to the cylinder. *g h i*, valves opening from the boilers towards the cylinder. *k l*, safety valves, one of which might be encased with its burthen, even inside of the boiler or pipe, as at *k*.

Boiler A has one flue collapsed and the other walled up to prevent a draft. The deficient boiler may have as much water kept in it as it will hold, to prevent burning. Meanwhile boilers B and C have not ceased for a moment to supply steam, and, consequently, power, to the cylinder.

Boiler C is placed in a manner that is believed would not be subject to collapses, and at the same time generate much more steam than the common method in proportion to the weight of the boiler and water.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

(Continued from p. 221.)

TABLE I.—PART I.

CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	‖ Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	12.54	14.47	15.72	0.50	566	50.00	616.00	41.5	38	10.28	2850	23.00	655500	255640	.389			
2					669	51.81	720.81		44	8.88	3275		753250	299136	.397	.397	8.88	
3					772	53.62	825.62		50	7.82	3800		874000	342632	.392			
4					875	55.43	930.43		59	6.62	4400		1012000	386128	.381			
5					978	57.24	1035.24		69	5.66	5110		1175300	429624	.365			
6					1081	59.05	1140.05		79	4.95	5825		1339750	473120	.353			
7	12.54	14.47	15.72	0.75	566	50.00	616.00	41.5	26	15.03	3050	23.00	701500	255640	.364			
8					669	51.81	720.81		27	14.48	3400		782000	299136	.382			
9					772	53.62	825.62		30	13.02	3650		839500	342632	.408			
10					875	55.43	930.43		34	11.50	3970		913100	386128	.422			
11					978	57.24	1035.24		37	10.56	4350		1000500	429624	.429	.429	10.56	
12					1081	59.05	1140.05		41	9.54	4825		1109750	473120	.426			
13					1184	60.86	1244.86		44	8.88	5275		1213250	516617	.425			
14					1287	65.23	1352.23		49	7.98	5875		1351250	561175	.417			
15					1390	69.60	1459.60		55	7.10	6500		1495000	605734	.415			
16					1493	73.97	1566.97		60	6.50	7250		1667500	650293	.390			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE I.—PART II.

CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
17	10.29	12.22	13.47	0.75	669	51.81	720.81	41.5	32	12.20	3475	20.75	721062	299136	.414			
18					772	53.62	825.62		33	11.84	3800		788500	342632	.434			
19					875	55.43	930.43		38	10.28	4175		866312	386128	.445			
20					978	57.24	1035.24		41	9.53	4600		954500	429624	.450	.450	9.53	
21					1081	59.05	1140.05		46	8.50	5125		1063437	473120	.445			
22					1184	60.86	1244.86		51	7.66	5700		1182750	516617	.435			
23					1287	65.23	1352.23		57	6.86	6300		1307250	561175	.428			
24					1390	69.60	1459.60		64	6.10	7050		1462875	605734	.414			
25	10.29	12.22	13.47	1.00	875	55.43	930.43	41.5	29	13.48	4425	20.75	918187	386128	.420			
26					1081	59.05	1140.05		35	11.16	5050		1047875	473120	.451	.451	11.16	
27					1184	60.86	1244.86		38	10.28	5585		1158887	516617	.445			
28					1287	65.23	1352.23		40	9.77	6100		1265850	561175	.443			
29					1390	69.60	1459.60		45	8.71	6675		1385062	605734	.437			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE I.—PART III.

CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
30	7.29	9.22	10.47	0.75	566	50.00	616.00	41.5	33	11.84	3300	17.75	585750	255640	.436			
31					669	51.81	720.81		38	10.28	3625		643437	299136	.465			
32					772	53.62	825.62		41	9.54	4075		723312	342632	.473			
33					875	55.43	930.43		47	8.32	4550		807625	386128	.478	.478	8.32	
34					978	57.24	1035.24		53	7.38	5125		909687	429624	.472			
35					1081	59.05	1140.05		58	6.74	5700		1011750	473120	.467			
36					1184	60.86	1244.86		65	6.00	6375		1131562	516617	.456			
37					1287	65.23	1352.23		73	5.35	7125		1264687	561175	.443			
38	7.29	9.22	10.47	1.00	978	57.24	1035.24	41.5	39	10.02	4925	17.75	874187	429624	.491			
39					1081	59.05	1140.05		43	9.09	5400		958500	473120	.493	.493	9.09	
40					1184	60.86	1244.86		46	8.50	6000		1065000	516617	.485			
41					1287	65.23	1352.23		52	7.52	6575		1167062	561175	.480			
42					1390	69.60	1459.60		58	6.74	7225		1282437	605734	.473			
43					1493	73.97	1566.97		63	6.20	7850		1393375	650293	.466			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE I.—PART IV.

CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
44	4.29	6.22	7.47	0.75	463	48.19	511.19	41.5	38	10.28	3010	14.75	443975	212144	.477			Experiments were made on a head of 11.75 feet, but the back of the chute was too high to permit a flow sufficient to fill the aperture; in consequence of this, the ratios did not increase in a due proportion to the diminution of the head. It has not been deemed necessary to record those experiments in the tables.
45					566	50.00	616.00		45	8.71	3475		512562	255640	.498			
46					669	51.81	720.81		50	7.82	3975		586312	299136	.510			
47					772	53.62	825.62		57	6.86	4525		667437	342632	.513	.513	6.86	
48					875	55.43	930.43		66	5.92	5150		759625	386128	.508			
49					978	57.24	1035.24		75	5.21	5875		866562	429624	.495			
50					1081	59.05	1140.05		85	4.60	6650		980875	473120	.482			
51	4.29	6.22	7.47	1.00	772	53.62	825.62	41.5	43	9.09	4350	14.75	641625	342632	.534			
52					875	55.43	930.43		48	8.14	4860		716850	386128	.538	.538	8.14	
53					978	57.24	1035.24		55	7.10	5450		803870	429624	.534			
54					1081	59.05	1140.05		59	6.62	6075		896062	473120	.528			
55	4.29	6.22	7.47	1.25	875	55.43	930.43	41.5	40	9.77	4850	14.75	718370	386128	.537			
56					978	57.24	1035.24		44	8.88	5350		789120	429624	.544	.544	8.88	
57					1081	59.05	1140.05		49	7.98	5925		873937	473120	.541			
58					1184	60.86	1244.86		54	7.24	6575		969812	516617	.532			
59					1287	65.23	1352.23		61	6.40	7225		1065687	561175	.526			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—PART I.

CHUTE No. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	12.54	14.47	15.72	0.50	360	46.38	406.38	41.5	38	10.28	2210	23.00	508300	168647	.331			
2					463	48.19	511.19		47	8.32	2650		609500	212144	.348			
3					566	50.00	616.00		55	7.10	3135		721050	255640	.354	.354	7.10	
4					669	51.81	720.81		66	5.92	3710		853300	299136	.350			
5	12.54	14.47	15.72	0.75	669	51.81	720.81	41.5	33	11.84	3420	23.00	786600	299136	.380			
6					772	53.62	825.62		38	10.28	3800		874000	342632	.393			
7					875	55.43	930.43		40	9.77	4155		955650	386128	.404			
8					978	57.24	1035.24		43	9.09	4560		1048800	429624	.409	.409	9.09	
9					1081	59.05	1140.05		46	8.50	5050		1161500	473120	.407			
10					1184	60.86	1244.86		48	8.14	5525		1270750	516617	.406			
11					1287	65.23	1352.23		53	7.38	6125		1408750	561175	.398			
12	12.54	14.47	15.72	1.00	772	53.62	825.62	41.5	29	13.48	3910	23.00	893730	342632	.383			
13					875	55.43	930.43		32	12.20	4160		956800	386128	.403			
14					978	57.24	1035.24		36	10.86	4560		1048800	429624	.409			
15					1081	59.05	1140.05		39	10.02	4990		1147700	473120	.412			
16					1184	60.86	1244.86		40	9.77	5375		1236250	516617	.418	.418	9.77	
17					1287	65.23	1352.23		43	9.09	5850		1345500	561175	.417			
18					1390	69.60	1459.60		46	8.50	6375		1466250	605734	.413			
19					1493	73.97	1566.97		53	7.38	7105		1634150	650293	.398			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—PART II.

CHUTE No. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Btm. of Bkt.	Top of Bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	10.29	12.22	13.47	0.50	360	46.38	406.38	41.5	39	10.02	2370	20.75	491775	168647	.343			
21					463	48.19	511.19		47	8.32	2830		587225	212144	.361			
22					566	50.00	616.00		50	7.82	3250		674375	255640	.379	.379	7.82	
23					669	51.81	720.81		67	5.84	3950		819625	299136	.364			
24	10.29	12.22	13.47	0.75	669	51.81	720.81	41.5	35	11.16	3635	20.75	754262	299136	.396			
25					772	53.62	825.62		39	10.02	4000		830000	342632	.413			
26					875	55.43	930.43		41	9.54	4430		919225	386128	.420			
27					978	57.24	1035.24		47	8.32	4910		1018825	429624	.421	.421	8.32	
28					1081	59.05	1140.05		54	7.24	5470		1135025	473120	.416			
29					1184	60.86	1244.86		59	6.62	6065		1258487	516617	.410			
30	10.29	12.22	13.47	1.00	978	57.24	1035.24	41.5	38	10.28	4780	20.75	991850	429624	.433			
31					1081	59.05	1140.05		40	9.77	5200		1079000	473120	.438			
32					1184	60.86	1244.86		44	8.88	5645		1171337	516617	.441	.441	8.88	
33					1287	65.23	1352.23		48	8.14	6275		1302062	561175	.431			
34					1390	69.60	1459.60		54	7.24	6900		1431750	605734	.423			
35	10.29	12.22	13.47	1.25	1081	59.05	1140.05	41.5	32	12.20	5150	20.75	1068625	473120	.442			
36					1184	60.86	1244.86		35	11.16	5580		1157850	516617	.446			
37					1287	65.23	1352.23		37	10.56	5880		1220100	561175	.460	.460	10.56	
38					1390	69.60	1459.60		41	9.54	6450		1338375	605734	.452			
39					1493	73.97	1566.97		44	8.88	7000		1452500	650293	.447			
1	2	4	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—PART III.

CHUTE NO. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
40	7.29	9.22	10.47	0.50	257	44.57	301.57	41.5	37	10.56	2050	17.75	363875	125152	.344			
41					360	46.38	406.38		45	8.70	2520		447300	168647	.377			
42					463	48.19	511.19		53	7.38	3010		534275	212144	.397			
43					566	50.00	616.00		64	6.10	3575		634562	255640	.403			
44					669	51.81	720.81		73	5.35	4160		738400	299136	.405	.405	5.35	
45					772	53.62	825.62		86	4.54	4875		865312	342632	.396			
46					875	55.43	930.43		105	3.72	5700		1011750	386128	.381			
47	7.29	9.22	10.47	0.75	669	51.81	720.81	41.5	42	9.31	3835	17.75	680712	299136	.439			
48					772	53.62	825.62		46	8.50	4240		752600	342632	.455	.455	8.50	
49					875	55.43	930.43		52	7.52	4790		850225	386128	.454			
50					978	57.24	1035.24		58	6.74	5350		949625	429624	.452			
51	7.29	9.22	10.47	1.00	875	55.43	930.43	41.5	42	9.31	4675	17.75	829812	386128	.465			
52					978	57.24	1035.24		46	8.50	5110		907250	429624	.473	.473	8.50	
53					1081	59.05	1140.05		50	7.83	5650		1002875	473120	.471			
54					1184	60.86	1244.86		54	7.24	6225		1104937	516617	.467			
55					1287	65.23	1352.23		62	6.30	6935		1230962	560175	.455			
56	7.29	9.22	10.47	1.25	978	57.24	1035.24	41.5	37	10.56	5120	17.75	908800	429624	.472			
57					1081	59.05	1140.05		39	10.02	5500		976250	473120	.484			
58					1184	60.86	1244.86		44	8.88	6000		1065000	516617	.485	.485	8.88	
59					1287	65.23	1352.23		47	8.32	6530		1159075	560175	.483			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—PART IV.

CHUTE No. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
60	7.29	9.22	10.47	1.50	1081	59.05	1140.05	41.5	34	11.50	5550	17.75	985125	473120	.480			
61					1184	60.86	1244.86		38	10.28	5950		1056125	516617	.489			
62					1287	65.23	1352.23		40	9.77	6400		1136000	561175	.494			
63					1390	69.60	1459.60		43	9.09	6850		1215875	605734	.498	.498	9.09	
64					1493	73.97	1566.97		46	8.50	7500		1331250	650293	.488			
65					1596	78.34	1674.34		50	7.82	8110		1439525	694851	.482			
66	4.29	6.22	7.47	0.75	463	48.19	511.19	41.5	47	8.32	3175	14.75	468312	212144	.453			
67					566	50.00	616.00		57	6.86	3725		549437	255640	.465			
68					669	51.81	720.81		66	5.92	4270		629825	299136	.474	.474	5.92	
69					772	53.62	825.62		76	5.14	4975		733812	342632	.466			
70	4.29	6.22	7.47	1.00	566	50.00	616.00	41.5	40	9.77	3700	14.75	545750	255640	.468			
71					669	51.81	720.81		46	8.50	4150		612125	299136	.488			
72					772	53.62	825.62		52	7.52	4635		683662	342632	.500			
73					875	55.43	930.43		58	6.74	5160		761100	386128	.507	.507	6.74	
74					978	57.24	1035.24		64	6.10	5750		848125	429624	.506			
75					1081	59.05	1140.05		71	5.50	6410		945475	473120	.500			
76	4.29	9.22	7.47	1.25	875	55.43	940.43	41.5	46	8.50	5000	14.75	737500	386128	.523			
77					978	57.24	1035.24		50	7.82	5500		811250	429624	.529	.529	7.82	
78					1081	59.05	1140.05		56	6.98	6100		899750	473120	.525			
79					1184	60.86	1244.86		61	6.40	6700		988250	516617	.522			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18.	

TABLE K.—PART V.

CHUTE No. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
80	4.29	6.22	7.47	1.50	978	57.24	135.24	41.5	43	9.09	5470	14.75	806825	429624	.532			
81					1081	59.05	1140.05		46	8.50	5875		866562	473120	.546	.546	8.50	
82					1184	60.86	1244.86		51	7.66	6525		962437	516617	.536			
83					1287	65.23	1352.23		56	6.98	7135		1052412	561175	.533			
84	4.29	6.22	7.47	1.75	1081	59.05	1140.05	41.5	35	11.16	6325	14.75	932937	473120	.507			
85					1184	60.86	1244.86		37	10.56	6765		997837	516617	.517			
86					1287	65.23	1352.23		39	10.02	7125		1050931	561175	.534			
87					1390	69.60	1459.60		43	9.09	7625		1124687	605734	.538			
88					1493	73.97	1566.97		44	8.88	8050		1187375	650293	.547	.547	8.88	
89					1596	78.34	1674.34		56	6.98	8875		1309062	694851	.530			
90	1.54	3.47	4.72	1.00	257	44.57	301.57	41.5	41	9.54	2350	12.00	282000	125152	.443			
91					463	48.19	511.19		60	6.50	3400		408000	212144	.520			
92					566	50.00	616.00		70	5.58	4010		481200	255640	.531			
93					669	51.81	720.81		82	4.77	4650		558000	299136	.536	.536	4.77	
94					772	53.62	825.62		95	4.11	5400		648000	342632	.528			
95					875	55.43	930.43		110	3.55	6225		747000	386128	.517			
96	1.54	3.47	4.72	1.25	566	50.00	616.00	41.5	57	6.86	3910	12.00	469200	255640	.544			
97					669	51.81	720.81		67	5.84	4475		537000	299136	.556			
98					772	53.62	825.62		74	5.28	5100		612000	342632	.559	.559	5.28	
99					875	55.43	930.43		86	4.54	5935		712200	386128	.542			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—Part VI.

CHUTE No. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
100	1.54	3.47	4.72	1.50	566	50.00	616.00	41.5	49	7.98	3885	12.00	466200	255640	.548			
101					669	51.81	720.81		59	6.62	4475		537000	299136	.557			
102					772	53.62	825.62		66	5.92	5050		606000	342632	.565			
103					875	55.43	930.43		73	5.35	5680		681600	386128	.566	.566	5.35	
104					978	57.24	1035.24		82	4.77	6465		775800	429624	.553			
105					1081	59.05	1140.05		93	4.20	7320		878400	473120	.538			
106	1.54	3.47	4.72	1.75	669	51.81	720.81	41.5	49	7.98	4450	12.00	534000	299136	.560			
107					772	53.62	825.62		55	7.10	4975		597000	342632	.574			
108					875	55.43	930.43		62	6.30	5575		669000	386128	.577			
109					978	57.24	1035.24		68	5.75	6150		738000	429624	.582	.582	5.75	
110					1081	59.05	1140.05		79	4.95	7025		843000	473120	.561			
111	1.54	3.47	4.72	2.00	978	57.24	1035.24	41.5	58	6.73	6075	12.00	729000	429624	.589			
112					1081	59.05	1140.05		62	6.30	6675		801000	473120	.590	.590	6.30	
113					1184	60.86	1244.86		72	5.43	7375		885000	516617	.583			
114	1.29	3.22	4.47	1.00	463	48.19	511.19	41.5	70	5.58	3545	11.75	416537	212144	.509			
115					566	50.00	616.00		82	4.77	4150		487625	255640	.524	.524	4.77	
116					669	51.81	720.81		96	4.07	4890		574575	299136	.521			
117	1.29	3.22	4.47	1.50	566	50.00	616.00	41.5	72	5.43	4075	11.75	478812	255640	.533			
118					669	51.81	720.81		78	5.01	4700		552250	299136	.542	.542	5.01	
119					772	53.62	825.62		94	4.16	5500		646250	342632	.530			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

[Continued from p. 247.]

(No. III.)

Letter from General Swift to one of the Committee on Explosions, dated *Geneva, New York, July* 15, 1830.

Dear Sir,—During my absence on Lake Ontario, your letter of the 6th instant, relative to the explosion of the boilers of the Helen M'Gregor, was received. I know very little about it, as you will perceive. In March last, I overtook the steam boat on the Mississippi, and made very particular inquiry of the passengers, in order to compare it with the accounts of former days of the explosions of the Ætna, and of the Hoboken ferry boat, at New York, &c.

From the inquiries it became soon apparent that a very common ignorance prevailed; for passengers rarely make any useful examination of steam machinery: very few of them knew any thing of the structure of the machine, or of the mode by which the steam is retained, or applied to motion.

Some of the passengers said that the boat, as it lay adjacent to the river bank, was so "keeled over" that one of the wing boilers could not have had any water in it, and that in that position it was when it burst or collapsed. Others said that the steam was not "let off," because the engineer was expecting that all persons would be on board in a moment or two, and thus the pressure of steam became too great and burst two of the boilers, endwise and upward. Others said that one boiler had burst, and another shrunk or collapsed. One of the passengers, who appeared to have a clear recollection, said that two of the boiler-heads, (for there were several contiguous boilers, as is usual,) burst towards the cabin, and came in contact with two iron stanchions, and were by them reflected, (direction changed,) and went through the sides of the bulk heads. All agreed that one boiler was thrown about forty feet from the boat, and struck in the bank with one end uppermost, and the head of the boiler of that end blown out. The iron stanchions, probably, saved many of the cabin passengers, who were at breakfast, from wounds and death. The passengers generally agreed that the boilers were weak: how they came to this, or any other, knowledge about them I know not. *The boat was an old boat.* When I went on board the Helen M'Gregor it was night; "the wreck cleared away;" the hull of the boat apparently little injured. I concluded that part had burst and part had collapsed, and that all the bursting had been upwards and sidewise, and endwise. The published account of a passenger contains as much as any one of them knew, or as any one on board knew, save the principal engineer, who, if a competent person, knew best the actual state of the boilers and machinery.

I am of opinion that carelessness and ignorance, combined, have been the chief causes of the bursting of boilers. No doubt many have been burst by using or wearing the boiler for too great a length of time; moreover, I do not believe that the state of the boiler is sufficiently often inspected, from its being a tedious operation and requiring a well informed person to make the survey. I have observed many engineers whose care and attention were exemplary, I have also seen those who did not pay the requisite attention to determine the relative state and position of the water and the steam, while fire was under the boilers. I consider low pressure steam boats more safe than high pressure, only because the former may admit of greater carelessness with impunity, than the latter. Much of the safety and strength of boilers depending on the quality of the iron, (used on fresh water,) it is very desirable to determine its durability or toughness by some legal inspection and seal; and whether brittle when hot or cold; and to know whether the plates in any one boiler have equal strength in those particulars before being put together.* The effect of high temperature upon the strength of iron plates, with reference to finding means to resist the effects of the sudden contact of steam, atmospheric air, &c. &c. should be experimented upon.

After all the precautions which theory and experience have suggested, there is one quality in men which will ever make a steam boiler a dangerous companion in travelling—I mean temerity. All know that without careful attention the strongest boiler may be burst, and that heedlessness is one of the common consequences of habitual association with dangerous machinery. From these and other considerations I am satisfied that there is no known safety for passengers conveyed by steam, equal to tow boats or safety barges; the loss in velocity is more than compensated by quiet and safety. Wishing you success in your laudable and scientific efforts for the public good, I remain

Your respectful friend,
J. Swift.

(No. IV.)

Dumfries, Virginia, August 20, 1830.

Sir,—A passenger of the steam boat Helen M'Gregor feels authorized to reply to the circular of the Franklin Institute, and briefly responds to the first inquiry; that boilers are often burst by the confidence engineers have in their strength, frequently by neglecting to let off the steam, and sometimes by cracks and flaws in the boiler heads. In the case of the Helen M'Gregor, the boiler-head of the one that exploded was cracked, and the engineer neglected to let off the steam in time: he had his hand on the wrench of the screw to let the steam into the cylinder at the time of the explosion.

Inquiry 2nd. The best means to obviate the frequency of explosions, is to pass a law requiring boiler-iron to be one inch thick; and in high pressure engines that not more than seventy-five pounds of steam shall be carried to the inch; the boats would go slower, but their safety would be beyond question. Boiler-heads to be of wrought iron.

---

* The necessity for which is suggested by the effect produced upon the boiler of the Ætna.

Inquiry 3d. The means to apply those remedies.—Let the Inspector of the customs at each port be directed to examine the thickness of the boiler-iron, to see that the heads are of wrought iron, and that the boilers are carefully rivetted, screwed, and hooped; and that for carrying more than seventy-five pounds of steam to the square inch, on conviction thereof, a fine of 1000 dollars shall be imposed; one-half to the informer, the other half to government, to cover expenses of prosecution, &c.

The boilers of the Helen M'Gregor, six in number, were about four feet in diameter, eighteen feet long, of wrought iron, one-fourth inch thick, with cast iron heads. The head that blew out broke into numerous small fragments, killed several persons, and wounded others.

Boilers should be of cylinder form, long enough to reach across the boat; the diameter about one-fifth of its length; American iron is safer, and less brittle than Swedish or Russian, and I think than English also.

Arrangement in the boat.—Across, so as to have the fire place on the guards, which should, at that point, project into a platform of the form of a segment. In this position, if the boiler heads blew out no danger would be apprehended to those in the bow or stern, above or below. At least nine times out of ten, boilers have blown their heads off, leaving the sides perfectly free from even a crack or flaw. When several boilers are ranged alongside each other, they have a connexion pipe, which terminates in a larger one, conveying the steam to the flues and cylinders. On this large pipe is fixed the safety valve, its form is simple, and may be understood by a school-boy.

Large boilers may be placed with safety on the guards, one on each, which would be quite as efficient, except at sea.

If this meets with approbation it will gratify the writer, whose name may be known of the postmaster at Dumfries.

W. S. C.

(No. V.)

Extract of a letter from Wm. Littlefield, Esq. of Newport, R. I., dated

Columbia, December 2, 1830.

My Dear Sir,—In conformity with your wishes, expressed at our last meeting, I took some pains while descending the Ohio, to inquire at every place where we stopped, and from every person I thought qualified to afford information, respecting the explosion on board the steam boat Caledonia. I will now give you all I could learn on the subject, though by no means sure that I can throw any new light upon it. The accident happened near the little prairie, between Memphis and New Madrid. At, or near, Memphis, they had wooded, and had proceeded about twenty-five miles without any thing unusual occurring; there was no boat within many miles of them, and I was assured that they had not the slightest idea either of outrunning a boat below, or of overtaking one above them. Indeed the time consumed in going the 25 miles seems to contradict the notion that the steam was too high, as from the best information it was not short of three hours. There were, I think, eight boilers; that which burst was one of the outside ones, near its centre, and about a foot from the bottom of it, whence it was ripped upwards by the steam a yard or more. One of the persons who saw it, told me that the aperture was large enough to take in a flour barrel. This boiler had a thin place in it which had been cut out the year before, and a new piece put in with *copper rivets*, and in that very place it burst. The boilers had not been cleaned since leaving New Orleans; there had been a freshet in the Missouri, and the water was unusually muddy. There was a sediment at the bottom of the boiler, but my informants differed as to its thickness; that, however, matters not, as they all agree it was baked as hard as a brick, and burnt. These are the facts, and the most probable solution is, that the rivets were burnt off where the sediment attached to the iron.

Since these terrible disasters they are getting much more careful. I am told it was no uncommon thing, a few years ago, to use puddled iron for boilers, when a person came along who beat them down rather more in their prices than they thought they could afford. They have improved their boilers, and now make the heads of *wrought iron*, which unscrew, and are large enough for a man to go in and clean them thoroughly; formerly they placed too much confidence in what they term blowing them out. As long as they keep the boat running, there is no danger from sediment, but if they stop for the night, as soon as the ebullition ceases the sediment deposits, and gets so hard that it cannot be raised again. The boilers require great attention in the western waters, even when the rivers are clear, as they are so strongly impregnated with lime, that an incrustation is formed almost immediately. These facts I think may be relied on: they are derived from the clerk who was in the boat at the time, and who is a man of intelligence, and I should say, of integrity.

I will say a word or two more on your favourite object. No blame, whatever, attached to the captain or officers. The former is now superintending the building and equipping one of the largest and most splendid boats I ever saw. At the moment of the explosion, his brother, the engineer, was standing within a yard of him, and had just tried the gauge cocks, and found the water as it should be. After that moment he never saw him more. The high pressure boats still continue in vogue; indeed, as constructed, on these waters, I think them quite as safe as on the other principle. You are probably aware that there is no such thing as a copper boiler; they are uniformly of wrought iron, generally a quarter of an inch thick. The high pressure engines have a fore and aft motion, which strain them. The former, too, takes up less room and weighs less, which is an object of great consequence, as they are obliged to use light draught vessels, at least half the year. The one we came down in only drew 14 inches, when light; and 20 inches with 80 passengers and their baggage on board.

(No. VI.)

Letter from a gentleman connected with the Caledonia.

Philadelphia, October 27, 1830.

Dear Sir,—In answer to your inquiry relative to the explosion of the boiler of the steam boat Caledonia, while running on the Mississippi, in May, last, I remark that the explosion was at first attributed to some defect in the iron of which the boiler was made; afterwards to the careening of the boat, in consequence of the passengers crowding on one side; but upon examination of the boiler, and of many circumstances since, it is the opinion of her owners, and of many scientific men, that it was the result of *carelessness.* The engineer, who was killed, had high reputation; but had, upon this trip, neglected to "blow out the boilers." The river was extremely muddy, and the boat was kept in constant motion for about seven days, when some derangement occurred in the machinery, which compelled a stoppage of several hours, (perhaps eight.) This delay caused the mud, which had been kept in motion by the boiling of the water, to settle and become baked to the bottom of the boiler. Upon the application of the fire, the iron was *burnt*, (which is, I believe the cant phrase,) or rendered brittle, and after being out two hours, the explosion took place; the boilers at the time being well supplied, for the engineer had just been trying the gauge of the water. The rent in the boiler was about 18 inches, about one-third distance from the bottom, in the *side.* The boilers were high steam cylinders, about 30 inches diameter, and 20 feet long, with two flues.

The above is, I believe, a correct statement of facts, hastily drawn up, and altogether at your disposal.

Yours respectfully.

(No. VII.)

Letter from Matthew Robinson.

New Albany, Indiana, August 16, 1830.

Sir,—In answer to your letter of inquiry into the facts relative to, and causes of the explosions of steam boilers, I take pleasure in communicating all the information of which I am possessed. The first case to which my attention was particularly directed, was that of the explosion of the middle boiler of the high pressure steam boat Car of Commerce, of 200 tons burthen, with five boilers. The after head of the middle boiler, which was made of cast iron, seven-eighths of an inch thick, gave way; which caused the boiler to jump from its bed 12 or 16 feet, carrying with it the four other boilers. On examination I found the one which burst was an L flue boiler, the other boilers having straight flues, running through both their heads, which adds much to their strength and safety. The bad construction of this boiler was, in my opinion, one cause of its explosion. Another, and more immediate cause, was the want of sufficient water in the boiler, they having stopped directly before the accident to repair the force pump, at the same time holding on to the steam, that they might be able to overtake a boat which was ahead of them.

The next explosion I particularly noticed was that of the high pressure steam boat Helen M'Gregor, with 6 boilers, 36 inches in diameter, with one L flue, 17 inches in diameter, in each boiler. These were all L flue boilers. The after head of the second one, from the starboard side, having been before cracked, gave way; and this boiler breaking its connexion with the others, went through the bow of the boat into the river. We are satisfied there was sufficient water in the boiler. At the time of the explosion, the engine was in the act of performing its first revolution after wooding at Memphis, on the Mississippi.

The third case was the collapsing of one of the flues of a boiler of the high pressure steam boat Huntress, 300 tons burthen, on her passage from New Orleans to Louisville. The boat had stopped her engine for a few minutes, for some purpose, and it is satisfactorily ascertained that the water was too low in the boilers; when, therefore, the engine was again set in motion, the explosion took place. Whenever the water in the boilers becomes lower than the uppermost part of the boiler with which the fire comes in contact, the part between the surface of the water inside and the aforesaid uppermost part of the boiler becomes red hot, and cold water being at this time introduced, steam is instantly generated in such quantity that no safety valve of the usual dimensions will allow it to escape, and an explosion is the inevitable consequence.

The fourth case was that of the high pressure steam boat Caledonia, on her passage from New Orleans to Louisville. This explosion took place while the boat was steadily running, which makes it differ from most other cases, and we must therefore look for other causes. They are found in the deficiency of the boilers themselves. In the first place, the boilers of the Caledonia are made of iron entirely too thin for boilers forty inches in diameter; but a more special cause arose from a patch put upon the lower part of one of the boilers with copper rivets, and the water in the Mississippi being very muddy, they did not keep the boilers sufficiently clean, but suffered the mud to accumulate too much between the flues and the bottom of the boilers; the mud being baked hard prevents the water from communicating with the iron of the boilers.

From the cases above noticed, as well as others to which my observation has extended, I am clearly of the opinion that all explosions, without exception, are to be attributed either to the carelessness of the engineers, or the deficiency of the boilers, and that the power of steam may be completely under the control of the careful and experienced artist. More effectual means of precaution might, however, be adopted; and I will mention one which I consider of much importance, which is, that the number and size of the safety valves should be increased. The boat I am now building, of 350 tons, is to have two safety valves of full size.

I hope you will pardon the delay which has arisen in answering your communication.

I am, with much respect,
Your obedient servant,
Matthew Robinson.

(No. VIII.)

Letter from Erasmus W. Benton, dated
New Albany, Indiana, August 7, 1830.

Gentlemen,—I have been called on by Mr. Robinson, of our place, to state some facts respecting the causes of the explosions which have so often happened on our western waters. As I feel a deep interest in the matter, I give some of the particulars of my observations, experience, &c. In the year 1815 I went on board the steam boat Enterprise as head engineer, and from about that time have been engaged in running or building, repairing, &c. until the present time. I now carry on the New Albany steam engine and sugar-mill establishment. There has been a great number of explosions; some of them I have been called on to examine, and make an estimate of cost, &c.; of a number of others I have done the repairs, and from observation and experience I beg leave to communicate some of my ideas on the subject.

The first I shall mention is the steam boat Constitution, at Point Coupée settlement, in 1817, near St. Francisville on the Mississippi. I was on board a few minutes after the explosion, from the appearance of the boiler it had been nearly dry, and by forcing a quantity of water into it, the head and part of the boiler gave way, and some 13 or 14 persons were blown into eternity by imprudence, neglect, &c. The boilers were made of $\frac{3}{16}$ inch iron, and calculated to carry about 80 lbs. pressure to the inch, and I believe the valve was loaded to more than three times that pressure. There were several others, such as the Atlas, Car of Commerce, and Star, which exploded from similar causes, partly from the want of water, and partly from a deficiency of strength in the machinery. The boiler heads of the Atlas I had taken out last summer, and I found them not more than $\frac{3}{4}$ to $\frac{7}{8}$ inch thick, and that of very imperfect cast iron. The explosions of the Grampus, Union, Porpoise, Huntress, and some others, arose entirely from the want of water in the boilers. The Helen M'Gregor and Tally Ho:—the heads of the Tally Ho's boilers were made of sheet iron, $\frac{3}{16}$ inch thick, and in turning the flanches where the head is riveted in the end of the boiler, the corner was turned so square as to crack the iron more than half off; one of the heads blew out half the way round and threw the boilers out of their stands, which let the steam escape with the loss of only three persons, as there were but few persons on board. I repaired the boilers by putting in new heads, and I found all of the heads in a very unsafe situation. The Helen M'Gregor's head had been cracked for some time, but as there were so many other boilers in the same situation, I suppose they thought their boilers as safe as others that had escaped. The Caledonia's explosion was occasioned by putting in copper rivets; the iron and copper together will not stand, you find. When wrought iron nails are put through copper flanches, or any other copper, where water comes in contact, the iron will corrode, and in a short time become perfectly loose. There might have been another reason for the explosion of the boilers of the Caledonia; the mud settling under the flue so as to let those rivets get red hot, and copper in that state is of little strength; the boiler iron of itself was scant $\frac{3}{16}$ inch thick, and I believe of very poor quality.

There are several other causes to account for these explosions, besides those which I have stated. When there is a sufficiency of water barely to keep running with safety; if while running, the boat comes too, as is frequently the case, the water wastes very fast, and if the flues do not become entirely dry, they become so nearly so that the water is low on the sides of the boiler above where the fire comes in contact with it; the sides of the boiler become so hot that as soon as the engine is started, the water rises in the boiler, which comes in contact with the hot iron, which generates steam as quick as the explosion of gunpowder. I believe in every instance that has come under my observation, where there was any thing near a sufficient quantity of water in the boilers, it has been the case that in a very few revolutions after the engine has started they have blown up. For example, take a sheet of boiler iron, heat it red hot, and pour water on it, and you will be convinced of the cause. One other cause of explosions is that the cylinders of some boats have become worn by use for some years, so that the packing that is made use of for packing the piston blows out, and with the escape steam works through the force pump and collects in such bodies under the flues, that it sometimes causes the bottom of the boiler and flue to become red hot, as was the case with the Amazon, Herald, Jubilee, and others, but the explosions were attended with less danger.

To guard against those accidents, first, there should be a committee appointed to examine and try the strength of the boiler as often as might be thought practicable, and to give the engineers what weight to carry on their safety valves, and hold the masters, owners, &c. accountable when they carry more weight than what they are allowed; the safety valve, or valves, should at least be as large as the throttle valve, for I contend, that if the boilers are sufficient to keep steam blowing off when the engine is in operation, the safety valve should be large enough to let it escape when lying still with full fires, as is often the case. The safety valves of more than half the boats, now in use on the western waters, are not more than half the size of their throttle valves, and not more than one-third of the boats have more than one. I have made valves and seats for many of the boats, and I know this to be the fact. You inquire, of what materials the boiler should be made; my opinion is, that good iron is the best for boilers for these waters, because the mud often bakes under the flues, and the iron will stand better when hot than the copper. The old practice of stopping and sending men in the boilers to clean out the mud, has been substituted by blow-off cocks, placed on the stands, or connexions under the boilers, which will answer the purpose for a short voyage, but when coming the distance from New Orleans to Louisville, they make a practice of blowing off once, or perhaps, twice, and I believe in some instances it does more harm than good, for they blow the water out with fire under the boiler, and the mud that is often settled under the flue becomes baked as hard as a burnt brick; I have taken it off when it was almost as hard as the iron itself. The common puppet valve, as now used, I believe to be as good a plan as can be invented. The only difficulty is, that many of the engineers on the river do not know what weight they carry. In the first place, the constructors of engines neither mark their weights nor their levers, and the engineers that run the boats put on old casting, or cord wood, or something else, as long as the valve keeps rising, without any reference to the weight which they should carry. I will give you more particulars hereafter.

Yours,
Erasmus W. Benton.

(No. IX.)

Letter from Matthew Robinson, dated

New Albany, September, 1830.

Sir,—In my answers to your first, which I hope you received in due time, I entered into the particulars of four explosions, all of which were caused by a defect in the construction, materials, or workmanship, or in the management of the engines. In all the explosions with which I am acquainted, say seven or eight, it was, in my opinion, in the power of the most superficial observers to have named the particular cause of the explosion. My opinion is that if they will, for all high pressure engines, have straight flues through, and connecting the two boiler heads strongly together, and those boilers and boiler heads of sufficient thickness and quality, with two force pumps, and two safety valves, for each set of boilers, with experienced engineers, who shall have the whole control of the engine, our printers would be called on to give the unpleasant intelligence of but few, if of any more explosions, and we should no longer hear of the death of human beings by such accidents.

To give you the exact size and relative thickness of our boilers would be attended with difficulty; some of them are 16 feet long, and 28 inches diameter, and are four-sixteenths of an inch thick, and you will find a set of boilers, 18 feet long, and 40 inches in diameter, and three-sixteenths of an inch thick.

With these remarks, I will refer you for further information to Edward Benton, brass founder, New Albany, and Andrew Watson, engineer of the steam boat Fame at New Albany.

N. B. I have neglected mentioning whether the boilers were of foreign or American iron; I believe they were of American iron generally; this, however I do not consider as the cause, but probably the want of a proper system and of experienced engineers. I have long expected these explosions. I have been 14 years here building or repairing steam boats, during which time I have known several men act in the capacity of firemen one day, and the next day I discovered they had been made engineers; and knowing, as I did, that they were not acquainted with any mechanical branch whatever, I dreaded the consequences. Moreover, I have known a man acting as a clerk in a mercantile house here, this being the only business, I believe, with which he was acquainted; the next day I have seen his name in a hand bill, appointed captain of a steam boat.

Please excuse my writing, and accept for yourself and the success of your investigations, my best wishes.

Yours, respectfully,
Matthew Robinson.

(No. X.)

Second letter from Matthew Robinson, dated

New Albany, September, 1830.

Dear Sir,—I received the second circular from the Committee of the Franklin Institute. I agree with the correctness of your remarks contained in it, and if the intelligent part of passengers would devote a portion of their attention to the arrangement and management of the engine, they might, in many instances, discover a want of system. The steam boats in 1817 and 1818, were generally 25 or 30 days on their passage from New Orleans to Louisville; in these last four years they have performed the same passage in 9 or 12 days, consequently they have increased their power more than 50 per cent. yet they have not increased the strength of their boilers in proportion to the height they now carry steam at.

Yours, respectfully,
Matthew Robinson.

[to be continued.]

Letter from Peter S. Duponceau, Esq., accompanying some cocoons produced on the estate of the Hon. Henry Bry, of Monroe, district of Ouachita, Louisiana, and which were deposited at the Exhibition of the Franklin Institute, in October last.

I have the pleasure of sending you a parcel of cocoons, weighing something less than two pounds, for which I beg you will obtain a place at the exhibition of the Franklin Institute. These cocoons are all that remain of a large quantity sent to me as a present by the Hon. Henry Bry, of Monroe, in the district of Ouachita, in Louisiana, and are the production of his estate. Although not remarkable for their size, they contain more silk than any I have ever seen, or, indeed, that I have ever heard of in any part of the world. Fourteen pounds and six ounces of them have produced, on reeling, three pounds eleven ounces of fine raw silk; which is about three pounds and three-quarters of cocoons to one pound of silk; which is truly astonishing, when it is considered that in Europe twelve pounds of cocoons are required to produce one pound of silk. I am speaking, it is true, of cocoons containing the live chrysalis; but allowing 25 per cent. which is a large allowance, for the loss of weight by baking, and the diminution during the voyage from the interior of Louisiana to this city, it would still have required on the European calculation, nine pounds of cocoons to produce one pound of silk, whereas that quantity was obtained from less than four. I have witnessed this fact, and can attest it of my own knowledge. You will observe that the cocoons are hard and compact; they reeled off quite to the chrysalis, which fell of itself into the basin, without a single particle of silk. I have thought this explanation necessary in order that the extraordinary excellence of these American cocoons may be fully understood.

The next best cocoons I have received this year, were sent me, also a present, by the lady of Thomas Sumter, Jr. Esq., the son of the venerable General Sumter. They were raised on the family plantation at Statesburg, in Sumter district, South Carolina. Five pounds of these produced one pound of raw silk, and no doubt would have produced more, if that excellent lady had not been confined to her bed by sickness, and could have attended herself to the rearing of her silk worms, as I had some before of her raising which did not yield to those of Louisiana. I have kept none of these cocoons, having converted them all into silk. They were of the large kind, and very beautiful.

I have seen cocoons as fine in their appearance as those I have mentioned, but none that produced so much silk; from whence I infer that our southern districts are admirably calculated for this production.

I have not attempted this year to manufacture any silk, as that is not my immediate object. What Mr. D'Homergue did last year, was only to show what could be done, even without the necessary machinery. Since that time a throwsting mill has been erected at Manayunk, at which I have had some silk thrown, reeled by our women in the second year of their instruction, which has turned out very well, one parcel having given only six per cent. waste, and the other seven, though the cocoons were of an inferior kind. I have given the thrown silk to a manufacturer, to be converted into stuff for silk hats. I mean to make similar experiments with the remainder, availing myself as much as possible of our various manufacturers. I find, however, that their looms, and their carding and other apparatus, are not exactly suited to the silk manufactures, nor is there yet any complete apparatus for the making of sewing silk. But we are proceeding so fast, that next year, or perhaps before, these inconveniences will have vanished.

I have, therefore, nothing to exhibit this year except these cocoons. I might send skeins of raw silk, as I did last year, but they must either be placed beyond the reach of hands, and then they cannot be well judged of, or they must be suffered to be handled, which soon renders them unfit for use. Besides, the proper test of the value of raw silk is by submitting it to the process of throwing. Silk may appear outwardly very fine, which, in that process, will run to waste.

I am, with great regard and esteem,
Dear Sir,
Your most obedient humble servant,
PETER S. DUPONCEAU.

Philadelphia, October 3, 1831.

P. S. I expect every day, from England, samples of stuffs manufactured from our American raw silk, but it is not probable that they will come in time for this exhibition, which I greatly regret.

Letter from P. S. Duponceau, Esq. to the Editor, on Gensoul's steam apparatus for silk filatures.

Philadelphia, 22nd September, 1831.

DEAR SIR,—In a French work on the subject of the silk trade,* which I lately received, I found a description, accompanied with a plate, of M. Gensoul's celebrated apparatus for conveying, by means of steam, an equal degree of heat to the water contained in any number of basins, employed in a filature of raw silk. Thinking that the publication of this description in the Journal of the Franklin Institute may be of use to our fellow citizens, at a moment when the public mind is actively employed on the subject of the culture and manufacture of silk, I have extracted it from the original work, and have the pleasure to send you a copy of it, and also of the drawing, of which you will make what use you shall think proper.

I am, very respectfully,
Your friend and humble servant,
PETER S. DUPONCEAU.

Report on M. Gensoul's steam apparatus for silk filatures, made to the Agricultural Society of the department of the Rhone, in France. By Dr. Terme.—With a Plate.

GENTLEMEN,—Although you are all well acquainted with Mr. Gensoul's admirable apparatus, still we think it adviseable to lay before you a hasty and general description which will suffice to convince you of its great usefulness. M. Gensoul's objects, and the results which he has obtained, are the diffusion of a sufficient degree of heat from a single furnace to any number of basins—the systematizing of the work of the women employed in spinning—the raising gradually, but with rapidity, the water in the basins to any required temperature, preserving it at the same time perfectly pure—lastly, the increasing the amount of the products of spinning.

---

* Du Commerce des Soies et Soieries en France, par M. Leon de Teste, Avignon, 1830.

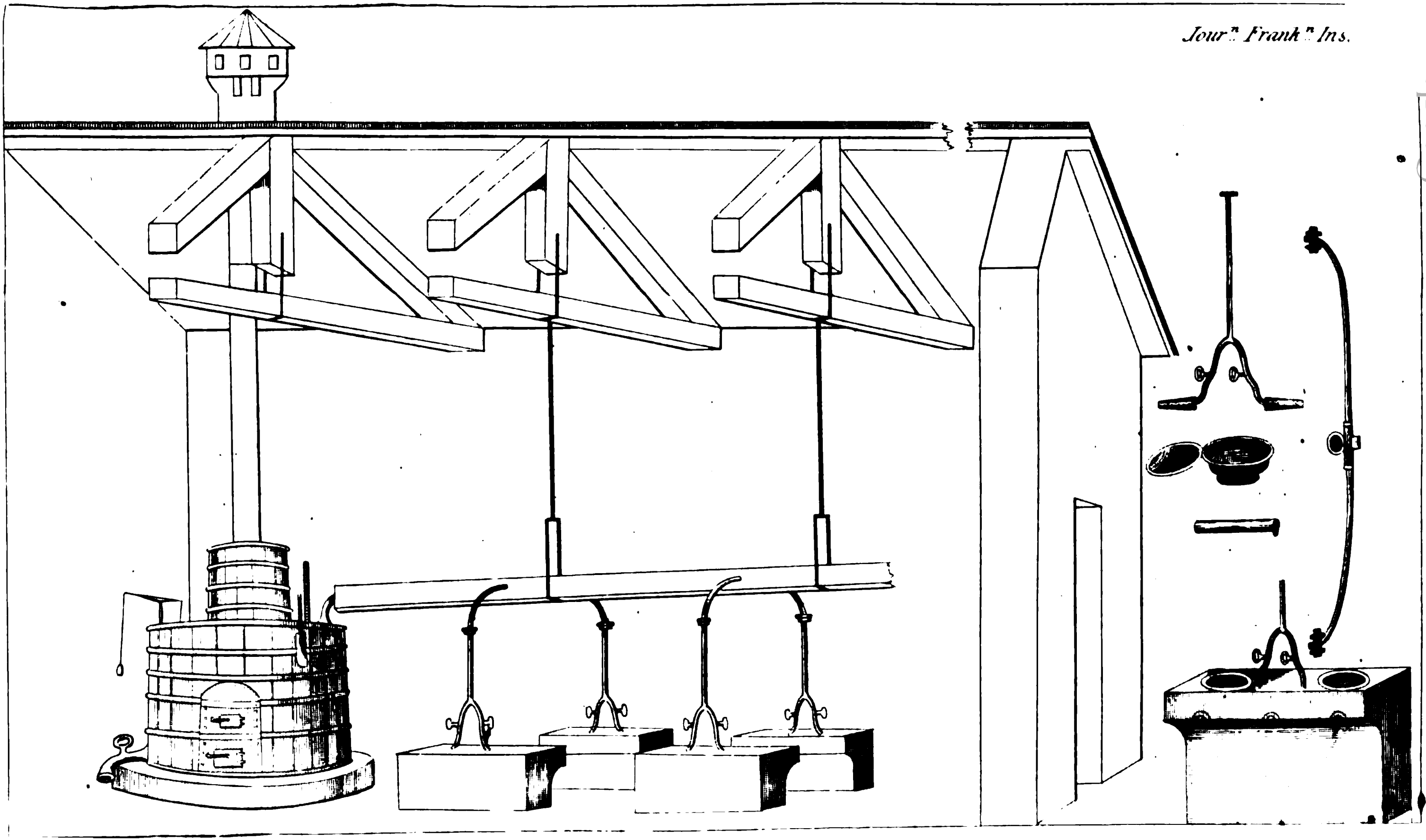
The apparatus consists of a boiler provided with a steam gauge and a safety valve; the boiler is placed in a furnace heated by means of bituminous coal.* The steam thereby generated passes into a main pipe which extends horizontally through the whole apartment at an elevation of about ten feet from the floor. From this main pipe, descending pipes branch out laterally; each of these is bifurcated, and supplies two basins with steam. These pipes are terminated by a tube, the extremity of which is perforated with small apertures that allow the steam to diffuse itself through the water in the basin. They are also provided with stop cocks near the end, by opening or closing which, the spinners are enabled to regulate the temperature. When steam is introduced into cold water it produces a hissing sound that continues till the temperature is raised to 167° F. From 178° to 190°, which is the best point for spinning, the water experiences a very distinct tremulous motion, which, at 203° passes into a lively ebullition; this is the proper temperature for beating the cocoons. These indications may serve in lieu of a thermometer, and are so used by the spinners, who being no longer diverted from their occupations by the necessity of keeping up their respective fires, as they used to be, are enabled to attend more steadily to spinning. The steam that condenses in the basins furnishes a constant supply of distilled or perfectly pure water, which gives to the products obtained by this apparatus, a marked advantage over those resulting from the old process. A comparison, made by the committee, of hanks of silk produced by the old and the new apparatus showed the superiority of the latter. By comparing these hanks with some of the first quality of Chinese silk, the committee satisfied themselves of the great and decided preference to be given to that of French origin.

To this report M. De Teste adds: This mode of working by steam, compared with the old process, shows a saving of three-fourths of the fuel, an increase in the quantity of the produce of labour, which may be estimated at one-tenth, and an improvement in the quality and brilliancy of the product. Moreover, by means of it, the white silk retains all its brilliancy.

The new process has been adopted, not only by the spinners of France, but also by those of Piedmont and Italy. The examination which M. Gensoul underwent before the chamber of commerce of Turin, and the experiments made by the members of that chamber, have conclusively established his reputation.

---

* Anthracite may, we think, be used with equal advantage.—Pub. Com.



FRANKLIN INSTITUTE.

Quarterly Meeting.

The thirty-first Quarterly Meeting of the Institute was held at their Hall, on Thursday, October 19th, 1831.

Thomas Fletcher, Vice President, in the chair.

Alexander Ferguson was appointed Secretary, *pro tem.*

The minutes of the last quarterly meeting were read and approved.

The quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on publications, with instructions to publish it in the Journal of the Institute.

Professor A. D. Bache, from the committee appointed by the Board of Managers on the subject, proposed an amendment to the constitution—which was laid on the table until the next meeting.

On motion of Professor A. D. Bache, a committee was appointed to address the Secretary of State on the subject of the Patent Laws of the United States.

Messrs. S. V. Merrick, Alexr. D. Bache, Isaac Hays, and Thos. Fletcher, were appointed said committee.

Mr. W. H. Keating offered the following resolution, which was unanimously adopted, viz:

Resolved, That this meeting have heard with deep regret of the loss which this community has suffered by the sudden death of their lamented associate, Reuben Haines, whose disinterested and zealous exertions in the promotion of science entitled him to their particular respect and esteem.

Resolved, that a copy of this minute be transmitted to his family.

On motion of Mr. C. C. Haven, it was

Resolved, That a committee be appointed to aid the corresponding secretary in ascertaining the number and extent of manufacturing establishments and mechanical institutions in this state, with statistical and general information concerning them, and that they be requested to report the results at a future meeting.

Messrs. C. C. Haven, W. H. Keating, W. R. Johnson, Frederick Fraley, Alexr. D. Bache, Saml. V. Merrick, Thomas Fletcher, Algernon S. Roberts, and James Ronaldson, were appointed said committee.

Resolved, That the committee be requested to direct their early attention to the manufacture of iron in Pennsylvania.

Thomas Fletcher, *Vice President.*

Attested.—Alexr. Ferguson, *Rec. Sec. P. T.*

Thirty-first Quarterly Report of the Board of Managers of the Franklin Institute.

To the Franklin Institute of the state of Pennsylvania, for the promotion of the mechanic arts, the Board of Managers respectfully offer their thirty-first quarterly report.

The affairs of our institution continue in as flourishing a condition as stated in our former reports. The exhibition, which has just closed, and of which a detailed report will soon be laid before the public, clearly shows that while the Institute retains the vigour and alacrity of its first efforts, it enjoys the confidence that results from years of tried usefulness. The depositors, and the public at large, evince a continued interest in our exhibitions, and the benefits which we know them to produce, offer an incentive to future efforts.

Our experiments on water wheels are in the course of publication, and will, it is presumed, add value to the pages of our journal.

Our experiments on the causes of explosions in steam boilers, still engage the attention of one of our committees.

Our reading room continues in good order, and is slowly winning its way into public favour. Our library and collections occasionally receive valuable accessions.

Our schools and lectures, which were interrupted during the summer season, will soon be reörganized, with increased prospects of usefulness.

The report of our treasurer will show the receipts and expenditures of the last quarter.

We invite our members not to slacken in their zeal to get us an accession of new members. Upon our increase in numbers depends our further development. Much as the Institute has done, there are still many objects deserving our notice, and which the limited state of our finances prevents us from fostering.

Our actuary has returned from a visit to the northern and eastern states, made with a view to extend an acquaintance in those states with the nature of our exhibitions, and solicit the co-operation of their manufacturers. It is believed that his journey has been eminently successful, but that the beneficial effects have not as yet been fully realized.

M. D. Lewis, *Chairman.*

Attest—William Hamilton, *Actuary.*

To the Board of Managers of the Franklin Institute of the state of Pennsylvania for the Promotion of the Mechanic Arts, the Committee of Premiums and Exhibitions, respectfully Report:

That in pursuance of the plan sanctioned by the Board, their seventh Exhibition of Domestic Manufactures was held at the Masonic Hall on the 4th inst., and that it continued open until the 8th, inclusive; during which time, it was visited by an immense number of our fellow-citizens, as well residents of this city as strangers. The committee estimate the visiters to have exceeded 40,000. Notwithstanding the great extension given to free admission, including the members of the Institute, depositors of goods, committees of arrangement and judges, persons connected with the press, and strangers of distinction, to each of whom tickets, admitting three individuals at any one time were issued, the receipts at the door amounted to

$1,218 50, which shows that about 10,000 persons paid for their admission. The expenses of the exhibition were, it is believed, somewhat higher than usual, but the committee entertain a hope that this sum will be sufficient to defray them entirely. The accounts are not yet settled: when this is done, a full statement of receipts and expenditures will be submitted. Among other benefits attending the present exhibition, the committee enumerate an accession of seventy-six members, and the sale of a few copies of the Journal.

But as the objects of the Institute in holding these exhibitions were in no manner of a pecuniary nature, it is to the benefits which they are calculated to produce on our manufactures, that we look as a reward for past exertions, and as an incentive to future ones. It is gratifying to observe the great improvement which each successive exhibition manifests in the manufactures already established, as well as the increase resulting from the new ones now, for the first time, noticed. Among the articles in which most improvement has been made in the last twelve months, we may mention the carpets, the flannels, the printed cottons, the stoves for anthracite, the writing paper, the Britannia ware, &c.

Among those now seen for the first time, are the natural yellow nankeen, the cotton hose, the silk plush, the cutlery, &c.

Great improvement in the taste of the manufacturers is evinced in the chaster and more graceful forms of the cabinet ware, most of the pianos, the grates, and other articles, the good workmanship of which often suffered much, formerly, by the abuse of ornaments. Even now we occasionally observe forms too massive, or inappropriate to the uses expected of the goods—gaudy or inharmonious colours—gildings too lavishly spread upon objects of furniture. But it is gratifying to see the disposition to improve as evinced by many of our manufacturers. Among the articles the good taste of which united all suffrages, we might cite the beautiful Brussels carpets from Lowell and Carlisle, the handsome sofa by White, the admirably executed chandelier of Cornelius, &c.

The committee would observe that while the quality of the goods was decidedly superior to that on former occasions, the quantity and variety of articles were also greater: the only branches in which our former exhibitions presented a richer display, were in cabinet ware, marble mantels, and grates. These are all very cumbersome articles to move; and in the case of the marble mantels, the erection of them is attended with so much expense, that the committee used no exertions to persuade the makers to send them. To this circumstance, and to the highly improved distribution of the goods, introduced by the committee of arrangement, we attribute the greater comfort of the visiters, even during those periods when the rooms were more crowded than we had ever known them to be before.

The committee have pleasure in stating that, with the exception of a few trifling articles mislaid, the goods were all returned in perfect order to their owners.

Annexed, we present, first, a list of the premiums which we consider to be due, and which we recommend to the Board to award—secondly, the catalogue, or invoice, of the goods deposited—and thirdly, the reports of the judges, many of which contain observations which we think will enrich the Journal of the Institute. They appear to have been, for the most part, drawn up with much more care than on former occasions.

Of the eighty-nine premiums proposed by the Institute, fifteen are adjudged to be due; by adding to these the fifteen extra premiums which the committee think ought to be awarded, we obtain the number of thirty, which we respectfully recommend to you to grant. They are as follows:

On Cotton Goods.

1. Premium No. 54, for the best sample of rich chintz prints for ladies' dresses, not less than three colours, and not less than 5 pieces of 28 yards each, is due to Andrew Robison, of Fall River, Mass., for specimen No. 237, deposited by Hacker, Brown & Co., which are remarkable for their firmness, colouring, and elegance of execution.

2. Premium No. 57, for the best sample of two blue prints, (same quantity to be exhibited,) is due to the Eagle Works of Belleville, N. J. for specimen No. 382, deposited by Gill, Ford, & Co., which were the best and finest exhibited, and fully entitled to premium.

3. Premium No. 60, for the best sample of 4-4 fancy gingham, in imitation of the Scotch, of yarn No. 45, or upwards, not less than ten pieces of stripes and checks, of equal lengths, to be exhibited, is due to John Steel, of Philadelphia, for his specimens No. 256, manufactured from yarns from No. 60 to 80. The committee understand that these are the finest yarns at present to be obtained in this market, and that this manufacturer deserves encouragement for the ability and industry which he has manifested.

4. Premium No. 49, for the best sample of white Canton flannel, 26 inches wide, not less than 200 yards to be exhibited, and to be superior to any before offered, is due to the Blockley works of Philadelphia, for specimens No. 34, which were the best exhibited.

5. An extra premium is due to John Colt, of Paterson, N. J., for specimens No. 187, deposited by Craig and Sargeant, being six pieces of cotton canvass, which the committee consider to be an object of great importance to the country. The experiments made on board of public and private ships, have established its character, and the attention of the public cannot be too frequently called to it.

6. An extra premium is also due to the Hon. John Forsyth, of Augusta, in Georgia, for the spirit of enterprise which has induced him to cultivate the variety of cotton from which the Aerumna nankeens were made. These goods, (No. 104,) deposited by Thomas & Martin, manufactured by Collet & Smith, of Paterson, N. J., are deserving of particular notice, as the colour is said to stand the severest tests, and as the extension of this variety of cotton bids fair to supply us with an excellent substitute for the Indian yellow nankeens.

7. In like manner an extra premium is due to Collet & Smith, of

Paterson, N. J., for the skill and ingenuity manifested by them in the manufacture of these nankeens, and for the success with which they have overcome the difficulties arising from the shortness of the staple, &c.

8. An extra premium is also due to Cunningham & Anderson, of Richmond, Virginia, for specimen No. 415, deposited by Hacker, Brown & Co., being their Brochellas, dyed blue in this city. They are well calculated for a cheap wearing apparel, and being stout and well made, will supply a desideratum which has been anxiously looked for. These are also interesting to us, as being the first specimens of cotton goods received from a manufactory south of the Potomac; these five pieces were found in the warehouses in this city, and not sent expressly by the manufacturers, they may, therefore, be inferred to be a fair specimen of the goods they make.

9. Although premiums No. 63 and 64 are not strictly due, yet the committee think that the Newburyport Hose Manufacturing Company deserve a medal for their extensive display of cotton and worsted hose and drawers, Nos. 220 and 221, deposited by A. Wright; they are the first of the kind exhibited here in any quantity. They are substantial and well made, and deserve encouragement, as constituting another branch of cotton manufacture in this country.

Honorary mention is due to Cornelius Vancourt, a pupil of the Pennsylvania Institution for the Deaf and Dumb, for the beauty, fineness, and finish of the checks, No. 28, exhibited by that praiseworthy Institution. They are the best presented this year, but are precluded from the premium, because checks equally good have, at former exhibitions, been presented by the same institution and rewarded with a medal. The committee understand that Vancourt is only 14 years of age, and has been but a short time in the weaving department of the Deaf and Dumb Institution.

To Joseph Smithurst, of Philadelphia, they also award an honorary mention for his jaconet cambric handkerchiefs, No. 334, which are woven of the best yarn now in the market; they are well made and deserving of notice.

Woollen Goods.

10. Premiums No. 73 and 74, on superfine blue and black cloth, and on $3 blue cloth, are withheld; but the committee believe that an extra premium is due to the Oxford Manufacturing Company, of Massachusetts, for specimen No. 23, deposited by C. C. Haven, of which the judges report, that "it is said to be of American wool; that it is the best specimen of cloth at $4 per yard, which they were called to examine; and that it will vie with any of foreign manufacture, as to texture, finish, and mixture, in all of which it bears ample testimony to the skill and ability of the makers."

11. Premium No. 78, for the best sample of fine white gauze flannel, is due to J. & T. Kershaw, of Blockley, Pennsylvania, for No. 53, which was the finest specimen of this article that had ever come under the notice of our judges: the wool is of the finest description, and the goods are remarkably well made, the only objection being a

slight bluish tinge which should be obviated in any future manufacture of the article.

12. An extra premium is due to the Salisbury Manufacturing Company, of Massachusetts, for specimen No. 22, deposited by C. C. Haven, being a great variety of flannels, exhibiting all the different kinds and qualities made by them, and showing a decided improvement in their manufacture; in the opinion of the judges they are in every respect equal to the imported article. The scarlets were particularly rich and brilliant in colour.

13. An extra premium is due to Joseph Ripka, of Philadelphia, for his green summer cloth, (No. 141,) cotton and worsted; the only imitation of the English, of this description, which has come under our notice. We consider this manufacturer as deserving of especial commendation, as well for this particular article as for his manufactures in general, which stand deservedly high in all the markets of the Union.

14. Premium No. 62 is awarded to the Middlesex Manufacturing Company of Lowell, Mass. for their merino cassimere, (No. 111,) deposited by Lewis and Whitney, made of cotton and wool. It is the best specimen of men's summer wear exhibited, and is in every respect equal to the imported article; evincing great perfection of texture and finish, as well as superior style in putting it up.

15. Premium No. 84, is due, we think, to the Buffalo Manufacturing Company of New York, for specimen No. 24, deposited by C. C. Haven, being two pair of white Mackinaw blankets, which will, in every respect, compete with the foreign article.

An honorary mention is also due to the same company for a large parcel of bed blankets, No. 469, which are considered equal to the best English blankets.

16. An extra premium is due to Col. John E. Colhoun, of Pendleton, South Carolina, for the specimens of blankets, (No. 542,) manufactured by him. The warp is of cotton, and the filling is of wool. These are very good samples of a coarse but substantial article, calculated for the use of negroes on plantations, and better than English goods of the same description. This, being the first manufactory of the kind established in South Carolina, deserves encouragement.

An honorary mention is due to Houston & Green of Groveville, N. J. for specimen No. 188, being five pieces of mixed satinets; the mixtures of which are remarkably well done, the fabric strong, and well cleaned from impurities and free from imperfections.

Carpets.

17. Premium No. 81, for the best sample of Venetian carpeting, is due to John M'Fee, of Philadelphia, for specimens Nos. 7, 8, and 9, being three pieces of 5-8 3-4, and 4-4 Venetian carpeting, which is a superior article, and the best of American manufacture that our judges had seen.

18. Premium No. 82, for the best specimen of Brussels carpeting,

is due to Samuel Given, of Carlisle, Pa. for specimen No. 21, deposited by John Hastings, being a piece of handsome and durable Brussels carpet, entirely of American material and manufacture. It is of excellent quality.

19. An extra premium is due to the Lowell Company, of Massachusetts, for the handsome display of Brussels and ingrain carpets, (Nos. 5, 6, &c.) deposited by C. C. Haven. The Brussels are made of foreign yarn, dyed in this country. The patterns are very handsome and tasteful, and the quality remarkably good. The ingrains are of superior quality but not exclusively of American materials, the warp having been imported in the grease. Were these carpets exclusively of American manufacture and materials, the premium would be due to them as a matter of course; and under existing circumstances we think that company has a just claim to a medal.

An honorary mention is due to Isaac Macauley, of Philadelphia, for his beautiful piece of painted floor cloth, (No. 432,) equal in texture and beauty to the English; as well as for his oil cloths for table covers, (431 and 432,) superior to any imported. We should not hesitate in recommending them for premium, if Mr. Macauley had not already twice received the medal of the Institute for similar goods. His manufacture needs neither praise nor encouragement from us, but we cannot withhold the expression of our admiration at the perfection which he has attained.

We also recommend an honorary mention to Doggett, Farnsworth & Co., of Philadelphia, for their beautiful hearth rugs, (No. 37,) which are much superior both in texture and workmanship to any other of American manufacture which we have ever seen.

An honorary mention is also merited by William Perry, of Philadelphia, for his cotton carpets, (No. 96,) which are a low priced article, superior to any of the kind we have yet seen—and to C. Lachapella, of Philadelphia, for his ingrain carpets, No. 99.

Silk Goods.

Although the display of silks was very pleasing, and evinced increasing interest in this department, yet nothing was offered which deserved a premium. An honorary mention is, however, due to Joseph Ripka, of Philadelphia, for a specimen of black plush, (No. 146,) made of American silk, with but a small admixture of foreign material. It is remarkable for the quality of the silk, the excellence of the manufacture, colour, &c.

Straw Bonnets.

20. Premium No. 83, for the best sample of straw bonnets, is due to Mrs. Elizabeth Henley, of Philadelphia, for an article, (No. 191,) far superior to any exhibited here before. The judges united with the visiters in bestowing upon it unqualified praise.

Iron and Steel.

Specimens of both these articles were received; the committee are not prepared to express their opinion as to their merits, as they are still in the hands of the judges undergoing a severe and thorough examination; but the committee think that an honorary mention is due to Hardman Philips, of Philipsburg, Centre county, Pennsylvania, for the industry and skill with which he pursues his experiments on the manufacture of iron. They leave no room to question the advantages to our country of the introduction here of the improved European process of manufacture. The interesting collection, (No. 302, et seq.) of coal, coke, hematetic iron ore, pig metal, bloom, wire, and screws, entitle him to the notice of the Institute. They were deposited by A. M. Jones.

Cutlery and Surgical Instruments.

21. Premium No. 38. For the best set of table cutlery, to consist of not less than 51 pieces, is due to Henry Barton, for his handsome display of table cutlery, No. 192, to 195, including 162 pieces, or *three* sets, all equally well made, and which the committee are assured were altogether forged and made in this country.

Hardware.

22. An extra premium is due to the Taunton Britannia Manufacturing Company, of Massachusetts, for its handsome display of Britannia ware, (specimen No. 1.) It is, in every respect, a superior article, and was frequently mistaken for a more costly metal.

Honorary mentions are due to Day & Shock; to M. Katez, and to Job Baker, for their improved locks, the merit of which, noticed at previous exhibitions, has been confirmed by the personal experience of them by the judges; they consider them superior to any other kinds ever imported into the country, but still somewhat deficient in the lackering.

Honorary mentions are also due to Robinson, Jones & Co., of Attleborough, Massachusetts, and to J. M. L. & W. H. Scovill of Waterbury, Connecticut, for their buttons. They formerly received a premium for similar articles. Messrs. Robinson, J. & C., exhibited buttons in quantities of not less than 300 gross. There is no branch of industry in this country, the merit of which is at present so well established, as that of buttons; the great improvements made in their manufacture during the last year, have placed them upon the most permanent footing. Consuming a considerable quantity of the gold produced by our southern states, they have almost driven the English article from the market, and have completely overcome the prejudice which too often attends the first use of our own manufactures.

An honorary mention is due to Jacob White, of Philadelphia, for his planes.

Silver and Plated Goods, Glassware and Porcelain.

The great perfection to which our silversmiths have attained renders it inexpedient for the Institute to bestow its medals upon this branch of the arts; otherwise a fine competition from the extensive workshops of Thomas Fletcher, Edward Lownes, Curry & Preston, and R. & W. Wilson, all of Philadelphia, would have produced much embarrassment on the part of the judges in deciding upon their respective merits. The Institute is under great obligations to these gentlemen for a really splendid display of the choicest silver urns, tea and coffee pots, cans, wine coolers, castors, cake baskets, goblets, pencil cases, &c.

In like manner the magnificent assortment of glassware from the New England Glass Manufacturing Company, of Massachusetts, from the Union Glass Company, of Kensington, Pennsylvania, and from Jackson & Bagot, of New York, as well as the beautiful display of porcelain ware by Messrs. Tucker & Hemphill, of Philadelphia, show that all these establishments maintain the high reputation which they have already acquired, and fully justify the encomiums and medals awarded to them at our former exhibitions.

Among the less showy but not less useful articles, is the durable and cheap flint stone ware of Horner & Shirley, of New Brunswick, New Jersey, which are likewise deserving of honorary mention.

The porter bottles, made by the New England Glass Company, and deposited by Mr. Muzzy, are undergoing an experiment in order to determine their strength and merits. Until this is completed, we forbear to express any opinion on the subject.

Stoves and Grates.

23. Great interest has been manifested by the depositors and visiters at the exhibition, as well as by the public at large, to ascertain the decision in relation to the stoves entitled to the high reward in premium No. 3, consisting not only of the usual silver medal, but also of the sum of one hundred dollars, which, by the liberality of the proprietors of the anthracite mines in Pennsylvania, was placed at the disposal of the Institute.

By the award of the highly respectable judges to whom this subject was referred, the premium is due to Powell Stackhouse, for his cast iron cooking stove, (No. 534,) which is neat and compact, and will be very durable. It bakes and boils well, and the whole arrangement is good. Its fixtures are well made, and consist of a large tin boiler for washing, a tin boiler and steamer for meat and vegetables, and a tin tea kettle; to all of which copper tubes are attached, which pass through orifices made in the back and side of the stove, over the fire, and from which an abundance of heat is communicated to the contents of the several vessels. Under the grate is a convenient permanent sifter to separate the ashes from the coal. The stove will weigh 1 cwt. 2 qrs.; and, with the fixtures as above, will cost fifteen dollars. It combines greater advantages than any now in use, and the fumes of the anthracite are not brought into contact with the food intended to be cooked. It, therefore, comes strictly within the terms of the premium, except that the price is 15 dollars, and not "*under* 15 dollars," as proposed; but your committee unite with the judges in recommending to the Board to overlook this slight discrepancy, and to award to Mr. Stackhouse the silver medal and the one hundred dollars, as soon as he shall have given satisfactory security to furnish within six months from this date, if required, fifty stoves, of similar construction and workmanship, at that price.

Lamps.

24. Premium No. 24. For the best and most extensive variety of mantel, astral, or hanging lamps, is due to Christian Cornelius, of Philadelphia, for his fine display of excellent lamps, but more especially for his splendid chandelier, (No. 364,) which is believed to be the largest and most tasteful work of the kind that has ever been made in America. It combines large size with perfect proportion and exquisite workmanship.

Books, Paper and Stationary.

25. Premium No. 19 is due to Robt. Donaldson, of New York, for specimen No. ——, being ten reams, (part of one hundred reams manufactured,) of quarto post paper, which was the best presented at the exhibition, and superior to any which the judges recollect having seen at any of our previous exhibitions.

Mr. Donaldson, also exhibited a fine assortment of foolscap, letter, scented, tinted, and embossed note and letter paper.

26. The committee also recommend that an extra premium be given to the Brandywine Manufacturing Company for their beautiful display of paper, (No. 392,) deposited by Thomas Fisher, which is deserving of great praise for its excellent quality and various beautiful tints, as well as for the neatness with which it is put up. We think it due to the manufacturers to state that it was not made with a view to competition.

An honorary mention is likewise awarded to J. Edgar, of Philadelphia, and to David Fell, of New York, as well as to J. Crissy, of Philadelphia, for their good specimens of book binding.

Cotton Seed Oil.

27. Premium No. 14 is due to Joseph M. & George Truman, of Philadelphia, for their purified cotton seed oil, (Nos. 16 and 17,) which is a new and successful attempt, and likely to become a very important article of trade.

Fine Arts.

28. Among the works of fine arts, few come before this society; but of those deposited at our exhibition, the wood cut engravings of objects of natural history, by Reuben S. Gilbert, (No. 179,) have appeared to us to entitle that young and estimable artist to the notice of the Institute; and we accordingly recommend that the silver medal be awarded to him.

Cabinet Ware.

The only sideboard offered to us was one by our fellow member of this Board, Charles H. White, (No. 404,) who, of course is not a competitor for a premium, but being assured that it is the sole and exclusive work of his foreman, David H. Bell, we recommend that an honorary mention be awarded to the latter for his beautiful workmanship.

The highest praise is also due to Michael Bouvier for a beautiful globe work-table, (No. 323,) the design of which is new, and the workmanship exquisite. The handsome specimens of work from Joseph Barry, and from Anthony Quervelle fully sustain the high reputation of these regular contributors to our exhibitions. The secretary and bookcase, (Nos. 125 and 126,) made by an apprentice to Thomas Robertson, entitle the maker to an honorary mention, as they form a remarkable piece of work for one who has not yet been two years at the trade; they are veneered with our native ash. It is not our purpose to notice the splendid furniture deposited by Mr. White, as his situation in the Board precludes us from paying him any compliment.

Balances.

We deem it just to award an honorary mention to J. Marshall, of Philadelphia, for a highly finished balance, (No. 515,) of the more delicate kind used by apothecaries. The judges report that when loaded with an ounce avoirdupois, it has proved sensible to less than one-fiftieth part of a grain.

Thermometer.

We also recommend that an honorary mention be awarded to Joseph Fisher, of Philadelphia, for his self-registering thermometer, (No. 311,) the beauty of its execution having been specially noticed by the judges on Philosophical apparatus.

Musical Instruments.

29. An extra premium is due to E. N. Scherr, of Philadelphia, for his harp guitar, (No. 345,) a new instrument, made and patented by him; and for his phyzharmonica, (No. 344,) which is an instrument deserving of particular commendation, being well adapted for the parlour or hall, of sweet yet powerful tone, and of beautiful workmanship.

30. To Francis H. Smith an extra premium is due for his Metrotone, (No. 198,) and for his grand harmonicon, (No. 19.) The former is an instrument of ingenious contrivance, capable of describing, to a well cultivated ear, thirty-six distinct sounds in one semi-tone. The latter, better known as the musical glasses, is a pleasing instrument, differing essentially from, and superior to, the musical glasses heretofore invented. The quality of the tone is rich, and with its sweetness combines great power.

Honorary mentions are due to Messrs. Loud & Brothers, J. J. Mickley, C. Meyer, and E. N. Scherr, of Philadelphia, and —— Geib, of New York, for a fine display of their pianos, sustaining well the justly acquired reputation of these able manufacturers.

It is with reluctance that the committee find themselves compelled to omit noticing many beautiful and ingenious fabrics which commanded the attention and elicited the admiration of the visiters; but they are precluded from doing it by the great length of this report, They will be all recorded in the catalogue of the exhibition now in the press.

The Board cannot, without injustice to their feelings, omit to tender the thanks of the Institute to those numberless friends who kindly undertook the arduous duties of the Committee of Arrangement, or the more unpleasant ones of judges: to the depositors for their libelra and enlightened co-operation in the views of the Institute; and to the public in general for the interest they manifest in our efforts, and of which so striking a proof was given by their favourable notice of this, our seventh, exhibition.

The committee have the pleasure of informing the Board that they have succeeded in obtaining the requisite number of medals for this exhibition, and that they will be ready for distribution within a few days after the award by the Board; that is to say, as soon as the names of the successful competitors can be cut upon them.

The committee expected to be able to announce that one of the most distinguished friends of manufactures, in Pennsylvania, had acceded to their invitation to deliver an address to the public on the occasion of the distribution of the medals; but motives of delicacy on his part, of which they cannot but approve, however much they may regret their effect, have induced that able friend of ours to decline the invitation, at least for the present.

All of which is respectfully submitted, by

William H. Keating, Joshua G. Harker,
Samuel J. Robbins, Alexander Ferguson,
James Ronaldson, J. Henry Bulkley,
M. W. Baldwin, Isaiah Lukens.
Fredk. Fraley,

At a meeting of the Board of Managers of the Institute, held October 13, 1831, the above report was read and accepted; and, on motion, it was

Resolved, That this Board approve of the award of premiums and honorary mentions recommended by the committee of premiums and exhibitions, and it was ordered that the report be published under the direction of the committee, and that the silver medals be delivered to the successful competitors, as soon as possible, and in such manner and form as the committee of Premiums and Exhibitions shall decide upon.

(Signed,) M. D. Lewis,
Chairman of the Board of Managers.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1831.

With Remarks and Exemplifications, by the Editor.

Continued from p. 253.

11. For a *Thrashing Machine;* Rinaldo P. Gillet, Victor, Ontario county, New York, June 13.

The patentee informs us that the difference between this machine and its predecessors, consists in the manner in which the teeth are set in the cylinder, and in the mode of gearing. The teeth are made in the form of staples, the two ends of which are to be driven into the cylinder. The machine is to be geared three times, instead of twice, and the wheels are to be larger than ordinary.

The making the teeth in the form of staples has been previously patented. As to gearing, we presume the object is to gain the requisite speed, and in this we have never heard that there was any difficulty in the machines now in use.

---

12. For improvements in the *Manufacturing of common wooden and other Clocks;* Orsimus R. Fyler, Chelsea, Orange county, Vermont, June 13.

The improvements described in this specification are three in number, as will be seen by the claim, which is in the following words—"What I claim as new in the above described apparatus, and for which I ask a patent is, first, the escapement; in this I claim the attaching of the spring, or springs, forming the pallets, in the manner, and upon the principle above specified, at, or near, the centre of the shell of the verge, and the giving to that end which acts as a horizontal pallet the curvature which produces the advantage before described, of increasing, with the spring of the pallet, the acuteness of the angle with which it acts upon the crown wheel. I also claim the guard constructed in the manner and for the purposes herein described and represented."

"I claim the employment of two hammers striking the bell alternately, by the action of the same pin wheel. And I also claim the employment of a roller, bearing upon the second coil of cord, for the purpose set forth in this specification."

The pallets are formed of thin watch spring, which, from their elasticity, and the form given to them, are intended to take off friction as they escape, without the use of oil. The patentee states that springs were used and patented by Jeremiah Dewey, for the same purpose, and describes the difference in the two applications.

The second improvement is in the striking part; in this, the same pin wheel acts upon two hammers, so that the bell is struck twice by the same gearing and motion which in other clocks produce but one blow. The hammers are made to form a counterpoise to each other, and only about one-half of the usual motion of the fly, and of the motive power is required.

The third improvement is designed to remove the objection to a double coil of cord upon the barrel; the ordinary effect of which is to increase the power and action when the second coil is on. This is effected by a friction roller, called a drag, placed parallel to, and almost in contact with, the barrel; it, however, is sufficiently distant not to touch the first coil of cord, but it bears upon the second, and being sustained upon a spring, is made to act with the force necessary to check the motion, so as to counteract the effect of the increased diameter. A spring alone, it is observed, may be made to produce the same effect.

13. For machinery for *Washing Rags in the manufacturing of Paper;* David Ames, jr. and John Ames, Springfield, Hampden county, Massachusetts; assignees of Samuel Eckstine, Philadelphia, June 13.

(See specification.)

---

14. For an improvement in the *Mode of constructing the Standing Press;* Charles Evans, Philadelphia, June 13.

(See specification.)

---

15. For *Combined Steelyards;* Martin Rush, Monroe county, New York, June 13.

Two steelyards are to be taken, and combined together by hooking the shorter end of one to the longer end of the other, the two thus forming a system of compound levers. The patentee tells us, that by this means a poise of one pound may be made to weigh several tons. We presume, however, that it will be found necessary to use other than common steelyards when the weight is to be greatly increased, and we know that this mode of weighing will be very far from accurate. The trifling distance through which the small weight or poise will pass, and the increased friction, will present obstacles which those used to accurate weighing can readily appreciate.

---

16. For a *Self-adjusting Drilling Machine,* for drilling stones; Jonathan Crane, Schenectady, New York, June 13.

This machinery is intended, principally, to be employed in drilling the stone blocks used on rail-roads. A frame is made, which, when the drills are to be worked by the power of a man, may sustain four drills, in a vertical position. The frame is to be placed upon the blocks to be drilled; when, by turning a crank, fixed to a shaft and carrying the necessary gearing, stampers, or trip hammers, are made to strike upon the heads of the drills, whilst they are turned round by endless screws properly fixed for that purpose. The face of the drill, instead of the ordinary double bevelled chisel, is to resemble two or three carpenter's chisels uniting in its centre. The patentee apprehends that a chisel with a single bevel will cut much more rapidly than the other forms, if, as in the present instance, the drill is constantly turned in one direction.

The claim is to the application of stampers, or trip hammers; the use of a spring above the stampers, and the peculiar construction of the drills.

---

17. For an improvement in the manner of *Balancing, or adjusting, the upper stone, or runner, of a pair of mill stones;* called a self-adjusting balance iron, for mill stones; Mark Lane Chase, Baltimore city, June 13.

(Specification to be hereafter published.)

18. For a mode of *Purifying and Beautifying of Sperm and Whale Oils;* John L. Embree, city of New York, June 13.

A solution of caustic potash is to be added to the oil, in the proportion of about six ounces to the gallon. The mixture is to be agitated, and exposed to the sun and air for a few days; when, it is said, the mucilage and colouring matter will be precipitated, and the oil rendered sufficiently pure for combustion.

---

19. For an improvement in the mode of *Making Wood Buttons,* commonly called dead-eyed wood buttons; De Grasse Fowler, Bradford, New Haven county, Connecticut, June 13.

The object of this invention is sufficiently designated in the claim, which is to "the addition of a metallic rim, or edge, to the common wood buttons now used for suspenders," &c. This rim leaves the wood bare in the centre, which is then to be drilled in the usual manner for attaching the button to the clothes.

---

20. For an improvement upon, or addition to, his combination of liquids as a *Substitute for Oil in the production of Light;* Isaiah Jennings, city of New York, June 13.

(See specification.)

---

21. For a *Washing Machine;* Samuel Jinkham, Enfield, Hampshire county, Massachusetts, June 18.

The dasher of this washing machine is made in the usual form of those which are suspended to a frame, and which are usually made to vibrate like a pendulum; but in the present case it is placed in a trough, in which it is made to slide from end to end. This is effected by placing a rack on the top of the dasher, and using a segment wheel or pinion, which is worked by a lever, to move it. The clothes, placed in each end of the trough, are thus squeezed between the dasher and the trough.

The patentee tells of many variations which may be made in his machine, but makes no claim to any part.

---

22. For a *Machine for dovetail tongueing and grooving, planing, and sticking mouldings* on piles, planks, boards, &c.; John Judge, Navy Yard, Washington city, June 13.

(The specification will appear in the next number.)

---

23. For an improvement in *Gun and Pistol Locks;* Abel Judson, New Lebanon, Columbia county, New York, June 13.

In these locks the guard and trigger are attached to the plate of the lock, which is to be affixed to the under side of the barrel and stock. The locks are of the percussion kind; the hammer strikes below, and the lock is attached to the stock by a screw passing from the upper side, through the breech pin, and into the plate which sustains the different parts of the lock.

The claims are to the arrangement of the several parts of the lock, and the uniting of them to the plate; to the making the dog operate both as a dog and spring, and to the manner of attaching together the lock, stock and barrel.

---

24. For an improved *Machine for Shelling Corn;* David Hitchcock, city of New York, June 13.

This resembles those well known shelling machines which have a cast iron disk, furnished with furrows or teeth, and are made to revolve vertically by turning a crank. It differs, however, in many particulars; its operating side, instead of being flat, is made convex, being a segment of a large sphere. The furrows, or knives, are peculiarly arranged; the hopper for the corn is improved in its structure, and there is a contrivance for preventing the too rapid revolution of the corn in shelling, which cannot be intelligibly described without a drawing. A plate of about 15 inches in diameter is accounted a good size; the whole machine, therefore, will occupy much less space than those heretofore made.

---

25. For a mode of *Hardening Hat Bodies on the cone;* Stephen Hurlbut, Glastonbury, Hartford county, Connecticut, June 13.

The cone on which the bat or web that forms the hat *body* is wound, is made hollow, and perforated with holes. This cone is placed upon a bench so constructed that steam may be admitted into it, and pass through its perforations to the body. This latter is covered with a cloth, and a cap fitting the cone is worked up and down over it by means of a shaft and crank. The description given is meagre and obscure, but, by the aid of the drawing, the general plan of operating may be made out.

---

26. For an improvement in *Candle Moulds,* called the sliding mandrel candle mould; Thomas Hewitt, city of Philadelphia, June 13.

We formerly described a candle moulding machine invented by the present patentee, and the machine now patented does not essentially differ from that alluded to, excepting in one particular, which is specifically claimed. The lower ends of the moulds are to be left open the full size of the tube; into each of these openings a cylindrical mandrel, or plug, is fitted, which will slide easily within the mould, and is perforated so as to allow the wick to pass through it. These mandrels, or plugs, are fitted to a rail below the moulds, one of them passing into each rail, and forming its end. When the tallow has been poured, and has set, the rail is raised, or the moulds lowered, by means of a rack, which causes the mandrels to force the candles sufficiently from the moulds to allow them to be readily drawn.

---

27. For *Twisting Penny Plugs of Tobacco;* John J. Heriges, city of Philadelphia, June 13.

These *penny plugs*, consisting of pig tail tobacco, are to have the two ends tucked in, in twisting, in a way particularly described, and are then to be rolled under a board, so as to form a neat cylinder. The tobacco is afterwards to be packed and fermented, when it is ready for use.

---

28. For a *Rotary Steam Engine;* Ebenezer R. Hale, Hyde Park, Dutchess county, New York, June 13.

This rotary engine is almost a perfect fac simile of the rotary pump patented by Messrs. Hale and Bell, in July, 1830, and published in our 6th vol. p. 305. The main difference is in the employment of two of the small wheels, marked B, in the drawing accompanying that specification. It may, in fact, be said of the greater number of the rotary steam engines, that they are better adapted to the raising of water, than to the purpose to which their inventors have destined them; they having hitherto been found unequal to the ordinary reciprocating engine, after the test of long continued use.

---

29. For a *Machine for Shelling Corn;* William Hoyt, Vernon, Jennings county, Indiana, June 13.

This patent is taken upon an amended specification, the machine having been originally patented on the 29th of April, 1828. It is essentially the same with the original shelling machine, invented more than twenty years ago, operating by a cylinder, from which spikes, or teeth, project, and act upon the corn against an elastic concave, or apron. The claims now made are to the manner in which the cylinder rests upon the bridge trees; to that in which the bridge trees rest upon the frame; and in which the springs are attached and operate on said bridge trees to give them elasticity, so as to admit ears of corn of different sizes.

The difference between this machine and those formerly patented is so slight, as to be a mere matter of arrangement; springs may be arranged in so many ways, to allow the requisite play to the cylinder, or apron, that a claim, founded upon any one in particular may be easily avoided, without being evaded.

---

30. For a *Fastening for Window Shutters, and Blinds;* William H. Mackrell, Bushwick, Kings county, New York, June 13.

A plate, with a slot or mortise through it, is screwed on to the blind, or shutter, through which there is also to be a mortise corresponding with that of the plate. Two separate catches project from the plate, one of them to catch on a fixture in the wall, the other on a fixture in the window frame. These catches or drops, are "placed in such a manner that the inside catch or drop which makes the shutter or blind fast to the sill of the house, by lifting the inside catch or drop, will lift the outside drop or catch; and the outside drop or catch, which will make fast to the catch secured in the house, will not lift the inside drop or catch, when the shutter or blind is shut." The making them thus constitutes the claim. The object to be attained is not explained, but it must be to prevent the inside catch from being lifted, by that on the outside, when the shutters are closed.

---

31. For an *Apparatus for Distilling and Evaporating*; Alexander Matthews, Island Creek, Jefferson county, Ohio, June 13.

This distilling apparatus is so very imperfectly described and figured, that we have found the attempt to understand its structure to be altogether unavailing. The boilers in which the beer, or water, is to be heated, are boxed round with wood; and as these boxes are rectangular, we suppose that the boilers are so also. There are three of these boxes, two of which stand in a line below, whilst the third, used as a heater, is placed above. The fire is to be conducted under the two lower boilers, and then by a tube through the upper one, which, with the exception of a flue passing through it, appears to be made altogether of wood. Tubes, supplied with cocks, lead down from the heater into this boiler below. The claims are to some things which are not represented, or which we cannot perceive, and our insertion of them, therefore, would not aid the reader in understanding the invention.

---

32. For a mode of preparing *Ardent Spirits from Grain*, &c. and of employing the residuum; Isaiah Jennings, city of New York, June 13.

(See specification.)

---

33. For making *Ornamental and Useful Articles from Anthracite* or Bituminous coal; Josiah W. Kirk, Schuylkill county, Pennsylvania, June 13.

The title of this patent sufficiently indicates its nature; we think, however, that the patentee would have done better had he confined his claim to anthracite, as from some species of bituminous coal, ornaments of various kinds have been made. Jet, is a light species of bituminous coal; and from the well known cannel coal, snuff boxes, columns, mantel ornaments, and various other articles have been formed, as it bears a high polish. The anthracite, in the hands of the present patentee, has, it is said, been wrought into forms of great beauty.

34. For a *Churn;* Philip H. Kimball, Salem, Essex county, Massachusetts, June 13.

This churn is to be a square box, measuring about 12 inches in the clear. There are to be three dashers, instead of the one usually employed, all attached to the same shaft, at a small distance from each other. The dashers are to be worked up and down by means of a lever fixed exactly like a pump handle. The claim is to the use of this lever. The patentee says, "I claim as my invention and improvement the application of the lever to the process of churning, and in the foregoing specification I have described the manner in which I have applied it." There are more than fifty patents for churns in which the lever is applied in various ways, and we cannot discover any novelty in the mode described; but, this apart, it will be seen that the claim is to the lever in general, and not to the mode of applying it.

---

35. For a machine for *Separating Grain, Rice, Peas, Grass-seed, Flaxseed, &c. from the Straw,* and for cutting straw; Abel Look, Pittsfield, Berkshire county, Massachusetts, June 13.

There is to be a revolving beater which is to act upon the grain, or other seed to be thrashed out. The supply is effected by means of a hopper, or of a revolving apron; the beaters operate against a hollow segment, supported on springs, having at its lower edge a rail, also supported on springs, and called a spring beater. When used to cut straw, knives are to be put in the place of the beaters upon the revolving shaft.

There is no claim, and as in the general structure there is no novelty, we are unable to discover for what the patent is taken.

---

36. For a *Mortising Machine;* Henry Marsh, Morristown, Morris county, New Jersey, June 13.

This mortising machine is stated to differ from those already in use in the following particulars.

In other machines the cutting apparatus works perpendicularly, in this *laterally* and *horizontally*.

In this the piece, if required, is mortised entirely through without turning it.

There is nothing used but the chisel, in making a mortise; it being unnecessary to bore a hole as is done with other machines.

Its work is more accurate, and performed with more despatch.

The combination of the respective parts to effect the object, is entirely new.

The claim made is to the general combination of the different parts as described and figured.

When a piece is to be mortised through, this is effected by two chisels, one on each side of the piece, worked alternately. The machine is clearly described, and distinctly represented, and appears to be well calculated to answer the end intended. Its particular arrangements would require extensive engravings to make them intelligible.

---

37. For an improvement in the *Hill Side Plough;* Cyrus H. M'Cormick, Rochester, Rockbridge county, Virginia, June 13.

In this plough the different parts are so arranged as to effect the turning of the mould board, and certain other parts of the plough, and the securing them to the share when turned. The share remains stationary, being so made as to operate equally well both ways. The claim is to the mode of turning and fastening, and to the particular construction of the share.

---

38. For an improvement in *Rail-ways, and in Carriages for the same;* Alexander M'Grew, Cincinnati, Hamilton county, Ohio, June 13.

We see but little that is new, and much that is old, in this specification. The rails, we are told, are to be placed upon posts, so as to produce a plane, and the whole subject is treated as though the rails were every where to be considerably elevated above the ground. The carriage is to be kept upon the rails by the use of friction wheels, instead of by flanches, and are to work against a guard or projecting piece; they are fixed upon what are called guard arms. A strap, or brake, is placed between the wheels at each side of the carriage, and these straps are to be made to bear on each of the wheels at the same time, by means of a lever. To enable loaded wagons and carts to cross the rail-road, they are to ascend an inclined plane on to a revolving platform, which turns on a pivot in its centre, and on friction rollers much like those used both here and in England. When the rail-way cars are to be loaded, it may be done from these inclined planes. There are to be double tracks in proper places, for cars to pass each other.

The claim is to "the construction of the rail-way with a guard or projecting piece; the vertical friction wheels; the guard arms of the carriage; the turning out platforms; and the revolving platform for crossing roads, and loading the rail-way carriage."

---

39. For an efficacious method of *Destroying Plants, Insects, or other animals noxious to Planters,* and particularly the noxious plant known by the name of Coco amer, Grass Nut, Souchet amer, Ciperus Tuberosus Acris, Hydra, in the state of Louisiana; Joseph Nicolas, Interior Parish of Lafourche, county of Lafourche, Louisiana, June 13.

(See specification.)

---

40. For an improvement in the art of *Melting, or Making, Iron;* John Patterson, Warwick, Orange county, New York, June 13.

This patent is taken for an improvement in blast and cupola furnaces. The improvement consists in putting two blasts at the bottom of the furnace, in the usual way, and two others at every two feet above, until there are six or seven blasts. The furnace is to enlarge upwards; and is intended to burn coal of every species.

There is no drawing accompanying this specification.

41. For an improvement in the *Paddle Wheel;* Benjamin Philips, city of Philadelphia, June 13.

This is said to be an improvement in paddle wheels, and in canal boats to be propelled by them. A twin boat is to be made, allowing a space for the paddle wheels between the two parts. These two parts are to be connected together by iron bars, standing in the direction of the beams. These bars have screws cut on them, with nuts moved by levers, by means of which the two parts of the boat may be made to approach, or recede, thus varying the space between them according to the width of the canal or lock, through which the boat is to pass. The buckets of the paddle wheel are to be made to swivel upon the arms by which their centres are sustained, so that they may stand either athwart, or fore and aft. There is no account given of how this turning of the buckets is to be effected, or by what means they are to be secured in their positions.

The connecting the parts of the boat in the manner described, so as to vary its width, and the causing the buckets to turn and adapt themselves to the variation in width, constitute the claims.

We are not aware of the necessity for lessening the width of a boat in this way, as canals and their locks are always proportioned to each other, the latter being made of sufficient width to pass a boat which can pass another on the canal. There may be instances where canals different in dimensions may be connected with each other, in which case, the plan in question, if good in other particulars, would offer some advantage.

42. For an improvement in *Window Blinds,* denominated the retaining blind; Nathan Palmer, city of New York, June 13.

These blinds are so constructed that they may be retained in any desired position, and may be closed so as entirely to exclude the light.

Sliding pieces are let into grooves in the cheeks of the blind, and a rail at the bottom, which may be raised or lowered by a thumb screw, moves the sliding pieces up or down. One pin on the ends of the slots turns in the cheeks of the blinds, and another pin is connected with the sliding pieces, not directly, but by the intervention of a brace, or joint piece, one end of which is screwed to the blind, and the other to the slide, without which contrivance the slides could not work, excepting the grooves were made wide, as has sometimes been done.

In some instances the slots are connected at each end to circular pieces, or wheels, which are let into the cheeks, and these wheels are made to revolve, and close or open the blinds, by means of the slides.

The claims are to the retaining the slots in any desired position, and to the two methods described, by which the blinds may be mounted; with such variations as may be made in attaining the same end.

---

43. For a mode of *Reducing Friction in Wheel Carriages* and all kinds of machinery; John Joseph Reekers, city of Baltimore, June 18.

The claim in this patent is to the reducing friction by means of the apparatus which it describes, consisting, mainly, of a hollow cylinder, rings, and rollers, or, in other words, of Garnett's friction rollers, which have been represented in nearly every elementary work on natural philosophy and mechanics, published within the last forty years. In most of the instances, and there are many, in which this apparatus has been patented over again, some variation of the original plan has been proposed, under the garb of an improvement: but in the present instance we have the genuine old fashion friction rollers in their original dress.

---

44. For a *Soda Fountain;* Alonzo S. Smith, Brutus, Cayuga county, New York, June 13.

We have already twice described this invention as the subject of a patent, once at page 176, and again in our last number, page 249. The present patent, and that noticed at p. 249, are of the same date, and were, certainly, interfering applications.

There is, in fact, no essential difference between the three, excepting that in the two former, tartaric acid and carbonate of soda were alone to be kept in solution in separate vessels, whilst in the present case we have the additional information that rum, brandy, gin, cider, meed, bear, &c. &c. may be drawn altogether, or any number of them, as may be desired.

The claim is to the double or many source fount, as applied to the purposes described.

---

45. For an improvement in the art of *Raising Water* by means of what is called the labour saving pump; Daniel Smith, China, Genessee county, New York, June 13.

This is merely a double lifting or forcing pump, such as is well known, and in established use. There are to be two barrels, pistons, and rods, worked by one lever without addition or variation from the old pump. If well made, therefore, experience tells us that it will work well, but not that it will save labour more effectually than its prototypes.

---

46. For *Sizing Hat Felts, and Napping Hat Bodies, by*

Steam; David Sutton, Lancaster, Gerrard county, Kentucky, June 13.

A hexagonal, or octagonal box is to be made to revolve, like a barrel churn, by turning a crank. Through one of its gudgeons steam is to be admitted from a steam boiler. When hat felts are to be reduced in size to prepare them for napping, they are to be put into the vessel mentioned, in a wet state; steam is then to be admitted, and when heated, the vessel is made to revolve until the intended effect is produced.

When bodies are to be napped, after *sticking* the napping on, they are to be put into the same vessel in a dry state, the steam admitted, and the machine turned by means of the crank, for twenty or thirty minutes, or until the process is completed. The claim is to these two processes.

---

47. For a machine for *Planing, Edging and Grooving Boards;* Jacob Tees, Kensington, Philadelphia county, Pennsylvania, June 13.

A bench is prepared to sustain the planes, and other apparatus required for the operation. The planes are to be stationary, and the board is to be forced against them. For this purpose the board is made to pass between friction rollers, turned by drums and straps. The first plane is to plane the surface. In its stock there are to be seven, or more, irons, all of the full width of the board to be planed. After passing this, it arrives between two other planes, similarly provided with irons, for planing its edges. Behind these it comes in contact with a pair of match planes, each with seven, or more, irons, to tongue and groove the board, which is thus finished. To reduce the board to a width, it is proposed to place a circular saw at the entering end of the bench, which saw is to be turned by the same power which gives motion to the plank.

The description of the operation of this machine goes on as smoothly as the proposition of Falstaff to kill the enemy by fifties, and we err greatly in our calculations should the machine eventually prove more successful than the *hero.* Thirty-five plane irons, at least, and seven of them six inches wide, all acting together, will present obstacles to the motion of a yellow pine board, which the friction rollers will scarcely overcome, and if they do, they must operate as flatting mill rollers, and condense the stuff. We see many other, and formidable, objections, to this machine, which we have not space or time to present to our readers.

We are also at a loss to know how the circular saw and the planes are to work upon the same plank at the same time: what is to become of the strip?

When this machine goes into successful operation, we shall be glad to hear of it; we will then cry *peccavi,* and cheerfully *send in our adhesion.*

---

48. For a *Horse Power Engine,* to be used for propelling ma-

chinery of all kinds; Isaac Van Doren, Hopewell, Huntingdon county, New Jersey, June 13.

This horse power engine is not a horse power steam engine, but is one intended to evade the laws of nature by causing the power of one horse to produce an effect equal to that of five. It is consequently to be "a cheap and efficacious substitute for steam and water power."

A horse is to turn a shaft by means of a lever, this lever carries an endless screw which acts upon a toothed wheel. Upon the shaft of this wheel, is a large spur wheel, which takes into a pinion, giving motion to a drum, a strap from which is to drive the machinery.

The inventor has, probably, not seen the necessary result of his invention, or he would have carried it still further. If the drum at the end of the train moves with the power of five horses, let him employ this to drive another *horse power machine*, and the next drum will have the power of twenty-five horses; and so on *ad infinitum*.

---

49. For a *Machine for Washing, Pressing, Ironing, Crimping, and Drying Clothes, &c.*; John Newhall, Dayton, Montgomery county, Ohio, June 13.

This, which may certainly be called the *washerwoman's assistant*, consists of separate machines, most of which are, in form and substance, like such as have been before used. The clothes are to be washed by being put into a dash wheel, turned like a barrel churn, having numerous holes bored through it, and turning by a crank, in a vessel containing soap suds. About thirty revolutions, we are told, will wash the clothes, but we are hard of belief. When very dirty, round wooden balls are to be put in with the clothes, as has often been done. The clothes, when washed, are to be put under a screw press instead of being wrung. They are to be dried by means of a large vessel of copper into which steam is to be admitted, and the clothes spread upon it. The ironing is to be effected by "a mangle and crimper improved *on the European mode*, by the additions of another roller and crimper. These are the main points of the system, to which no claim is made either in whole or in part; we are left, therefore, if we can, to consider the whole as new.

---

50. For a *Weighing Machine;* Thaddeus Fairbanks, and Erastus Fairbanks, St. Johnsbury, Caledonia county, Vermont, June 13.

This is a machine intended for weighing loaded wagons and carts. The vehicle to be weighed is driven on to a platform, which is suspended upon proper fulcrums and levers, and these are to act upon a steelyard, by which the weight may be ascertained with considerable accuracy. Such machines are common on turnpike roads, and at coal yards; and the machine now patented is a mere variation of the general principle upon which these are made, without presenting any thing which can be fairly called an improvement. The patentee has described the whole machine without claiming any part.

---

51. For machinery for *Moulding and Docking Crackers,* sea biscuit, cakes, &c., and for making wafers; Jonas P. Fairlamb and Miller Dunott, Wilmington, Newcastle county, Delaware, June 13.

The dough from which crackers, &c. are to be made is passed between rollers which deliver it of the proper thickness; it then passes between another pair of rollers, one of which has a smooth surface, and upon the periphery of the other is placed a row of moulds which cut the crackers; from these moulds they are made to fall regularly upon an endless apron. The cylinders are hollow, and within that furnished with moulds, a smaller cylinder revolves, which acts upon the heads of followers or pistons, contained in each mould, and forces the cracker out. Another modification of the machine is described, but it operates upon the same principle.

The claim is to moulding and docking by cylindrical pressure.

---

52. For a *Paste, or Composition, to be used in Sharpening Edge Tools,* and for grinding and polishing metals generally; Peleg Barlow, America, Dutchess county, New York, June 13.

This paste, or composition, is to be formed of a mixture of white and red lead with linseed oil and emery, or with red lead, oil, and emery, which is to be spread upon wood, and to form rifles for sharpening scythes, &c.

The resemblance between this patent and one obtained in March last is so great, that we are not aware of the object of the patentee in obtaining a new one, excepting it is merely to vary the proportions of the ingredients.—See page 8, of the present volume.

---

53. For a *Thrashing Machine;* Isaac Van Doren, Hopewell, Huntingdon county, New Jersey, June 13.

In this machine there are two revolving cylinders between which the material to be thrashed is made to pass. Upon one of these cylinders there are springs, or vibrating beaters, and upon the other stationary beaters. The general arrangement of this machine is considered by the patentee to be different from any other extant, it having, he thinks, nothing in common with them but those accessory parts without which such a machine cannot exist: his claims are made accordingly.

---

54. For a mode of *Spinning on Throstle Frames,* called the Bobbin regulator, John Brown, of Providence, and John Sandish, of Cranston, Providence county, Rhode Island, June 13.

For the washer cloths generally used, the patentee proposes to substitute a small whirl, which is to be placed under the bobbin, and this, with the aid of friction bands, is to regulate the draft upon the thread. The plan appears to be good, and new, but without a drawing the mode of using this whirl and its appendages cannot be clearly explained.

---

55. For an improvement in the steam engine, called the "*Steam Lever Rotary;*" John Catlin and Calvin Fletcher, Cincinnati, Ohio, June 13.

Steam is to be admitted into a steam pipe, which is bent round so as to form a hollow ring. Within this ring is a wheel the surface of which is formed into steps or vanes, and from the hollow ring several pipes conduct steam on to the surface of this wheel, discharging it tangentially, and consequently blowing the wheel round.

The patentees claim the discharge of steam directly upon the surface of a wheel, thus avoiding all necessity for packing.

This is certainly a primitive steam engine, being in principle as ancient as the days of Hero of Greece. It will, undoubtedly, blow the wheel round with great velocity, but where economy is to be considered, and power in proportion for the outlay for fuel is required, this machine will not establish itself.

---

56. For applying the power of a pendulum clock to a *Swinging Cradle;* John M'Kenney, Chester, Butler county, Ohio, June 13.

The cradle is to be the bob of a pendulum, there being a wire rod at each end by which it is to be suspended. The proper wheel work, escapement, and weights, are supported by suitable frame work, the whole of which assumes a very formidable appearance, when the object in view is considered. The claim made is to the application of the power of the pendulum clock, to the rocking of a cradle.

A former patent for rocking a cradle by clock work, upon similar principles, received due attention, (see vol. v. p. 126,) and we think it unnecessary to indite any thing new upon the subject.

---

57. For a *Churn;* Samuel Sweet, Readfield, Kennebeck county, Maine, June 13.

This churn is spoken of in the specification as being one of a very superior order, yet it is so similar to many other churns, that its appearance would not have secured the preference to which it lays claim. It consists of a box in which a shaft is made to revolve horizontally. This shaft carries two wide dashers, which agitate the cream. The bottom of the box is made circular, and the sides straight. The claim is to this circular bottom and the straight sides, to the horizontal shaft, the wide ladle boards, and several other things, among which are the "turning with a hand crank; also the cheapness and convenience of the work."

58. For a *Washing Machine;* James Appleton, Richmond, Virginia, June 13.

This is a swinging machine, with polygonal sides; the inside of the swinging box is furnished with rollers, secured at each end, which are to aid in cleansing the clothes when the rocking motion is given by a lever.

---

59. For an improvement in the *Winnowing Mill;* Moses Elliot, Boscawen, Merrimack county, New Hampshire, June 13.

This fanning machine differs considerably in the arrangement of its parts from those in common use, which difference is summed up in a clear manner in the claim of the patentee, of which an abstract must suffice.

The fans move horizontally in a drum, reducing the height of the machine to about three feet.

The channel for the passage of grain is narrowed, which gives more force to the wind, and cleans the grain more effectually.

The length of the mill is reduced by the position of the box and hopper, which are placed over the fan.

A more simple combination is given to the parts generally.

---

60. For an improvement in the *Machine for Cutting Crackers,* &c. (patented on the 13th of September, 1830,) by Jos. Clark and Henry Henderson, city of Baltimore, June 13.

The parts of the machine as described in the first specification all remain unchanged, with the exception of the sliding board to receive the crackers after they are cut; for this, an endless apron, revolving upon rollers, is substituted, and upon this the dough is made to pass from the cylinders by which it is rolled out. The cutting is effected upon this revolving apron. The claim is to the use of the apron upon which the crackers are cut, and by which they are carried off. It will be seen that in a patent of the same date, No. 51, a revolving apron is used to carry off the crackers from a machine in which they are cut upon revolving cylinders.

---

61. For an improvement in *Piano Fortes;* Thomas Kearsing, Henry O. Kearsing, George T. Kearsing, and William F. Kearsing, city of New York, June 13.

The principal improvements here claimed consist in a different arrangement of some parts of the English action from that heretofore pursued. These cannot be described without a drawing. The mode of hanging the wire on the hitch pins, is also new, and claimed by the patentees. Instead of the usual mode of forming an eye, or loop, by doubling the wire and twisting the two parts together, three or more turns are made by the wire round the hitch pin, and the short end is then to be turned several times round that part of the wire which is to be strained, which mode of procedure, it is said, prevents the crippling of the wire.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improved mode of constructing the Standing Press, for pressing paper, tobacco, or other articles, requiring to be pressed. Granted to CHARLES EVANS, *city of Philadelphia, June* 13, 1831.

THE bottom, or bed, and the top piece, which also answers as a platten, or follower, I usually make of cast iron, although, for certain purposes, wood, or other suitable material, may be employed. Instead of cheeks, two screws, of such length and thickness as may be required, rise vertically from the bed, one standing near each of its ends. A metal box, or nut, is adapted to each of these screws, and these nuts are firmly fixed in the centres of cog wheels. These wheels are of such diameter that when the boxes are in their places, the peripheries of the wheels will approach each other within the distance necessary to allow of an endless screw to pass between them. The cogs of the wheels are cut, or made, bevelling, so as to adapt them to the threads of such a screw.

The platten, or follower, is placed below the two cog wheels, so as to raise and lower with them. The lower ends of the boxes, or nuts, are attached to the upper side of the followers, and are to swivel in or on it. Upon the upper side of the platten, an endless screw turns in collars, its threads taking into those of the cog wheels. At the outer end of its shank, there is a crank, or handle, for the purpose of turning it.

The screws which occupy the places of cheeks in the ordinary press, must have their threads cut in a direction contrary to each other; that is, one of them must be a right, and the other a left, handed screw; as the endless screw will turn the cog wheels in opposite directions.

A press, operating in a way somewhat similar, may be made with the side screws both right or left handed, but in this case two endless screws must be cut on the same spindle, and so placed that one of the screws may act upon the periphery of one wheel, and the other on the periphery of the opposite wheel. This spindle must extend along the front or back of the press.

What I claim as my invention, and for which I ask a patent, is the application of screws instead of cheeks to the sides of the standing press, so connected that the raising or lowering of the platten or follower must be effected by means of cog wheels, and an endless screw or screws, operating upon the principles herein described.

CHARLES EVANS.

Specification of a patent for an improvement upon, or addition to, a combination of liquids to be used as a substitute for oil in the production of light; for which a patent was granted on the 16*th day of October*, 1831. Isaiah Jennings, *city of New York, June* 13, 1831.

I take the spirit, or essential oil, distilled from tar, or any of the vegetable essential oils, or the spirit of coal tar, which is a species of naphtha, or that obtained from the Seneca oil, or other bitumens, by distillation, and combine them with alcohol, or spirits of wine, as I have heretofore combined the essential oil, or spirits of turpentine, therewith. This I do in such proportions as may be found expedient, according to the nature and purity of the articles employed. When the alcohol is highly rectified, it will combine with a larger portion of the other ingredients, than that which is of lower proof. The general rule is to add to the alcohol as much of the other ingredient as can be taken into combination with it, which may vary from one-fourth to one-eighth part, the quantity of alcohol always greatly predominating.

The combination of liquids thus produced, I use as a substitute for oil, to burn in lamps of any description in which oil may be burnt.

What I claim as my invention, or improvement, is the combining of the articles above specified, with alcohol, in the manner, and upon the principles hereinbefore set forth, for the purpose of burning the same as a substitute for oil in lamps.

Isaiah Jennings.

Specification of a patent for a mode of preparing Alcohol, or Ardent Spirit, from Grain, or other vegetable substances capable of undergoing the vinous fermentation, and of employing the residuum more advantageously than has been hitherto done. Granted to Isaiah Jennings, *city of New York, June* 13, 1831.

I take the grain, meal, flour, or other vegetable matter to be fermented, and I add to it a quantity of water sufficient to give it a consistence about equal to that of hominy, or paste, and in this state I add to it yest, or other ferment, and allow the vinous fermentation to take place; as soon as this is completed, and before acidity commences, I place the material so fermented in proper distilling vessels, and submit it to the proper degree of heat, by means of steam, heated air, or any other agent the temperature of which can be governed so as to prevent all danger of burning, and I then draw off all the spirit from it. After this has been effected, I continue the heating process until I render the vegetable substance as completely dry as though it had been kiln dried. This substance is then fit to be stored away, or ground into meal, and bolted, so as to be employed as food for man, or other animals. Wheat, or other grain, which has been submitted to this process will make perfectly sweet bread, and will rise without requiring yest, or other ferment.

What I claim as new in the above process, is the fermenting of the vegetable materials with no more water than is necessary to give them the consistence designated, and afterwards employing the dried residuum for the purposes hereinbefore set forth.

Isaiah Jennings.

Specification of a patent for a new method of Washing Rags in the manufacturing of Paper. Granted to David Ames, *Jr. and* John Ames, *Springfield, Hampden county, Massachusetts. Assignees of Samuel Eckstein, Philadelphia, June* 13, 1831.

Instead of the washer, or screw, now in use, I employ a circular disk or plate, which is covered with wove wire, and is made to revolve within the cistern, or vat, of the paper engine, against the side opposite to that on which the cylinder, or roll, is placed. The revolution of the circular disk is effected by means of a pinion upon the shaft of the engine, which pinion mashes into a cog wheel placed upon the same shaft upon which the disk, or plate, is fixed, and with which it revolves.

A brass ring, which may be one foot in diameter, and one inch in thickness, is fastened by bolts, or screwed, on the inside of the cistern, concentric with the shaft upon which the disk, or plate, revolves. This shaft carries, upon its inner end, a brass wheel, which may be twenty-two inches in diameter, more or less. The face of this wheel, towards the inside of the engine, receives the covering of wove wire. It has on the back of it a secondary or smaller rim, of such a size as to fit against the fixed ring, first mentioned, and forming a joint with it. A rim of wood is screwed on to the face of the larger brass wheel, to which to attach the facing of wove wire through which the water is to run from the vat. Below the fixed ring, a space six inches wide, and an inch deep, is cut out of the side of the engine, and through to the bottom; this space, when covered with a sheet of copper, forms a vent for the water which passes from the engine through the wove wire into the space formed by the projection of the fixed ring. Through this wire disk, and these openings, the water finds a free exit, without obstructing the motion of, or wasting, the pulp. A larger quantity of water, therefore, may be admitted into the vat, than is ordinarily done; and the washing is more rapidly, effectually, and economically performed, than by any other means now in use.

What I claim as my invention, is the revolving disk, or plate, covered with wove wire, and so placed within the vat of a paper engine as to allow the water to pass freely through it, upon the principle, and for the purposes herein described.

Samuel Eckstein.

It will be seen that the effect produced by the invention of Mr. Eckstein is similar to that of Mr. Ames, the specification of which may be found at page 127. To prevent all interference the Messrs. Ames became the purchasers of the improvement above described.

Specification of a patent for a new method of destroying noxious plants, insects, or other animals, and particularly the noxious plants known by the names of Coco Amer, Grass Nut, Souchet Amer, Ciperus Tuberosus Acris, Hydra. Granted to Joseph Nicolas, *Interior Parish of Lafourche, county of Lafourche, Louisiana, June* 13, 1831.

It consists, 1st, in ploughing the field infested with the above noxious plants, insects, or other animals, to the depth of eight or ten inches, more or less, according to the soil. 2nd. In a carriage moved by steam, or other power, upon which a steam boiler is fixed; to which boiler are adapted a force pump moved by steam or otherwise, to convey water in the boilers, and one or several pipes to convey the steam from the boiler to any desired portion of the surface ploughed. The heat of the steam instantaneously effects the destruction intended.

If the first aspersion, or sprinkling, be not sufficient for obtaining the desired effect, (which is very seldom the case,) the ploughing and sprinkling of steam must be repeated.

Jos. Nicolas.

ENGLISH. PATENTS.

To James Down, *Surgeon, for his having invented certain improvements in making Gas for illumination, and in the apparatus for the same. Sealed 5th August,* 1830.

This invention consists, first, in making or generating gas for the purposes of illumination, out of certain portions of the residuum, which, in the ordinary mode of conducting the process, is not available for those purposes—by passing crude or nascent gas, with its vapour of tar and ammonia, through a long stratum of ignited charcoal or coke, and thereby evolving an additional quantity of gas from the impurities of the said nascent gas; and, secondly, in an improved box or vessel, contrived to contain a *long* stratum of charcoal or coke, in a state of ignition, in a *small* compass.

The impure gases produced by the usual modes of distillation from pit coal, or any other substance from which gas can be procured in the ordinary way, is to be passed through an extended stratum of ignited charcoal or coke, by means of the improved apparatus: which consists of a box or vessel of iron, or such other substance as will withstand the action of heat, the box being furnished with divisions, and nearly filled with charcoal or coke.

This box or vessel may be connected with the ordinary retorts, and by this means the necessary purity will be obtained by the very process of generating it from the impurities of the nascent gas, without any special apparatus for that purpose.

In the common mode of making gas fit for illumination, as generally practiced, the gas is passed through a variety of processes and apparatus to effect the different progressive degrees of purification required, while the residuum, containing much good gas, is not converted into that material. In this improved mode of making or generating gas for illumination, the gas in its crude and nascent state, with the tar and its vapour, the ammoniacal liquor and its vapour, and also the sulphureous gas, is passed at once into the said box or vessel, constructed and filled as aforesaid, and thereby sufficiently purified, while it is evident that the external shape, general form and dimensions of the box or vessel may be arranged and adapted to its situation, so as best to suit the circumstances of the particular establishment where the gas is to be generated and used.

The before described improved box, vessel, or apparatus, with its passages, must be filled, as before stated, with charcoal or coke, and heated to a degree of temperature sufficient to cause the enclosed charcoal or coke to be in a constant state of ignition; the heat necessary to be applied to this box, vessel, or apparatus, must be limited to that of a good gas making heat, for if it should be urged to a higher temperature than this, it will be injurious to the box, or vessel, and at the same time detrimental to the illuminating power of the gas.

The heating of this improved box, vessel, or apparatus, may be accomplished by setting it in the same furnace, or bed, with the retorts, and connecting two or more retorts with it; or the like effect may be produced by embedding it in a distinct and separate furnace, but the method before described is preferred. It is only necessary further to state, that when it is required to remove the charcoal or coke from the above described improved box, or vessel, for the purpose of replacing fresh materials therein, it may be done by displacing the mouth-piece or top parts of the box, or vessel; and it will be obvious that whatever sized box may be resorted to, it must be so contrived and placed, that its contents may be capable of being removed at the pleasure of the operator.

The patentee says, "I claim as my invention, first, making or generating gas, for the purposes of illumination, by passing crude or nascent gas through a long stratum of ignited charcoal or coke, whereby I evolve an additional quantity of gas from certain portions of the residuum, which, in the modes hitherto adopted, are useless for those purposes; and whereby I do away with the necessity of a separate purifying apparatus. And, secondly, the improved box, or vessel, contrived to obtain that object, by means of the extended stratum of charcoal or coke, hereinbefore described."

To Thomas Bulkeley *Doctor of Physic, for his invention of a method of making or manufacturing candles. Sealed 26th January,* 1830.

These improvements in making candles consist in three particulars:—first, in making wax candles in moulds, instead of forming them by rolling the wax, which is stated to be the ordinary way of producing wax candles; secondly, in making a case of wax shaped like a candle, which is to be afterwards filled with tallow or oil, or other combustible material suitable for making candles; and, thirdly, in forming and adapting a sliding wick for a candle, which shall descend as the candle becomes consumed, and never require snuffing.

The first object requires but little further explanation. To cast wax candles in moulds, it is obvious that the wax must be poured into the moulds in a hot and liquid state, and when perfectly cold, the end of the candle is to be struck with a small wooden mallet for the purpose of disengaging it from adhesion to the surface of that mould, when it may be withdrawn. The patentee has not said in what particular these mould cast wax candles will be superior or preferable to those made by rolling the wax in the ordinary way.

In putting the second feature of the invention into operation, it is proposed to pour into the candle moulds the melted wax, as in the previously described process of moulding; and on the wax having cooled and become partially set or hardened, which it will do round the internal surfaces of the moulds before the wax in the central part of the candle has become set, then to pour out of the mould the liquid portion of the wax which filled the central part of the candle, and allow the shell of wax thus formed on the surface of the mould to become hard. This shell may then be made the mould in which melted tallow, or cocoa nut, or other oil, may be poured, and a wick introduced for the purpose of making a candle resemble externally a wax candle; and as the wax will not melt at the same temperature as tallow, the candle will not be subject to guttering down, but the tallow or oil will always burn below the surface of the outer case of wax, which will gradually melt down by the heat of the flame; and have the same transparent appearance as a wax candle.

Lastly, the improved wicks, which are to be adapted to candles, are to be formed by extending a thin string of flax through the candle, and placing upon this string at the upper end a small tube of straw or paper, which tube will be sufficient to collect the fluid tallow, or other material, by capillary attraction, and so to form a wick or receptacle for the combustion of the tallow, and its conversion into the gas that supports the flame of the candle; and as the tallow becomes consumed, the wick will gradually descend, guided by the string still constituting the wick, while the string will moulder away as the candle becomes consumed, and not require snuffing.

To ROBERT STEIN, *Gentleman, for his invention of an improvement in applying heat to the purposes of Distillation. Sealed* 13*th December*, 1827.

THE object of the patentee appears to be to economise fuel in the process of distillation, and for this purpose he proposes to connect a series of stills, and to conduct the heated vapour evolved from one still into or under the next still in the connected range, for the purpose of heating the wash contained in the second still, and causing it to throw off its spirituous vapour, which in like manner is to be conducted to a third still, for the purpose of heating it, and so on.

No precise construction of apparatus is claimed, but it is proposed as eligible to attach a sort of jacket or casing to the lower part of each of the connected stills, and to carry a pipe from the head of one still to the under part of the next, through which pipe the vapour passes, and coming in contact with the bottom of the wash vessel of the next still, heats the liquor therein sufficiently to drive off its spirituous vapour, as in the ordinary process of distillation, which vapour is carried forward from the head by a pipe, to the under part of the succeeding still, and so on to the last still of the range, from whence the vapour there evolved passes to the worm tub; and the vapours which have thus operated, and have given off their caloric, and become condensed into liquids in the vessels under the several stills, are drawn off from those vessels for rectification.

The patentee does not confine himself to the above described apparatus, but sometimes carries the vapour by a pipe, from the head of the first still, down into the wash of the next still, where it communicates its caloric to the wash, and so prevents the useless dissipation of the heat.

The stills being arranged and connected in any convenient way, are to be furnished with all the necessary pipes and cocks for conducting the wash, and for drawing off the product; but these form no part of the invention, which the patentee says, "consists in applying some portions of the heat used for distillation over and over again."

Remarks on Wheels for Locomotive Engines, with a description of the Coal Wagons employed on the Liverpool and Manchester Rail-way.

From Wood's Treatise on Rail-roads, new edition.

IT has been urged against case-hardened wheels, that their hardness makes them liable to cut the rails: this might apply to narrow rubbing surfaces, but cannot have any application to one surface rolling over another, when the hard surface is the rolling one, and also the broader. I have often examined, very carefully, their action upon the rails, but could never find any tendency in them to cut the rails; when the common wheels are indented on the surface of the rim, they are very liable to injure the rails, from the periphery thus grooved breaking the sides of the bearing surface of the wheels off, and leaving only the middle section. This is frequently the case, as may be seen on all those rail-roads upon which the common wheels have been long used. The universal adoption of case-hardened wheels on all the principal rail-roads, in preference to the common wheels, is, however, the best criterion which can be adduced of the general belief of their superiority. The case-hardening is, as previously explained, effected by running the metal against a cold cylinder of cast iron. I am inclined to think, that this tends to form the wheel more perfectly cylindrical than casting in the ordinary way: which will lessen the resistance by remedying any resistance arising from the undulatory motion produced by the imperfect circular form of the rim.

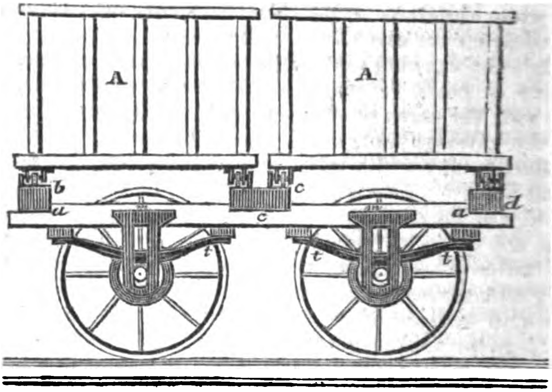
The very great rapidity at which it is now proposed to travel upon some of the public rail-ways, renders the liability of case-hardened wheels to break;—not only from the brittle nature of the material, but also by the friction of the wheels upon the rails at such great velocities, heating and expanding the rims—an object of very serious consideration; various plans have already been devised to obviate this objection. It will be subsequently seen that the cast iron wheels of the Killingworth engines had been hooped with wrought iron tires, which was not only found to be quite practicable, but also a great saving in the wear, compared with common cast iron wheels; since that time, the wheels of the engines made by Messrs. Stephenson & Co. have been either made of cast iron, hooped with wrought, or with wooden spokes, on which was laid a malleable iron tire: wheels thus hooped, though more expensive, seem quite necessary for the rapid rate at which some of those engines are propelled. The same plan of hooping the cast iron with wrought iron tires, has also been adopted with respect to the common carriages, which, like the engine wheels, though more expensive, is strictly necessary.

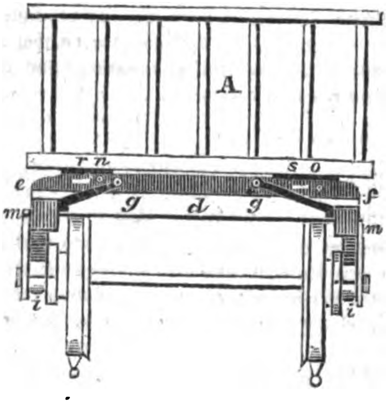
Messrs. Jones, of London, have a patent, which is described in the sixth volume of the "Repertory of Patents," p. 279, Third Series, where the spokes are screwed into the nave, and thereby any strain by the unequal expansion of the rim is obviated.

The axles of the carriages used at the coal works are universally made of wrought iron, being square at the ends, to fit the square hole *d*, through the nave of the wheel. Upon the frame of the carriage is fixed a chair, which rests upon the axle, the latter being turned smooth, to reduce the friction as much as possible. Upon the side of this chair a projection is cast, extending beyond the side of the frame of the carriage, which projection, by rubbing against the faced flanch *f*, in the nave of the wheel, prevents the carriage from coming in contact with it; and, being kept well greased or oiled, reduces the friction, when, by one side of the road being lower than the other, the body of the carriage is thrown to one side; or this is sometimes effected by putting a loose ring upon the axle, which rubs against the flanch *f*; the latter I consider more preferable, as rubbing nearer the centre of motion, and more likely to keep lucubrated with oil. These chairs have successively been made of wrought iron, brass, and cast iron; the latter I consider the most eligible, for reasons which I shall hereafter assign. The size of the axles will necessarily depend upon the diameter of the wheels, and the weight they have to sustain.

Upon the wagons used to carry the coals from the collieries in the neighbourhood of Newcastle, the diameter of the axles is from two inches and a half to two and three-quarters, and the diameter of the wheels about three feet; the weight of the carriage and load amounting to above three tons.

Upon public lines of road, the form of the carriages will, as before stated, vary with the nature of the goods they are required to convey; bulky goods of course requiring larger carriages. The drawing of the carriages previously given, is for the conveyance of coals; in these, the sides of the carriage come between the wheels, and the upper part projects in the form of a hopper: this plan for coal wagons is very convenient, where, as in the north, the coals are to be emptied out at the bottom, at the shipping places. For the conveyance of coals into towns a different form is necessary, as in this case, the carriage used for the rail-way must either be so constructed as to travel upon common roads, or the body of the carriage must be of such a form that it can be transferred to wheels suitable for the streets.





Figs. 1 and 2 of the cut represent the form of those intended to be used upon the Liverpool and Manchester rail-way for coals; fig. 1 being a side view, and fig. 2 an end view. A A is the body of the carriage, which is a square box, capable of containing about 25 cwt. of coals. Upon the frame *a a* of the carriage are fixed the cross sills *b c d*, fig. 1, and *d* fig. 2; on these, angular plates of iron rest, forming short pieces of plate rail-way along the cross-framing. An end view of these plates is shown in fig. 1; and *e f*, fig. 2, is a side view of the plate resting on the sill *d*. On the under side of the framing of each of the boxes, four small vertical sheeves are fixed, which support the boxes, and which run upon the plate rails, shown also at *n o*, fig. 2. To prevent the boxes from rubbing against the sides of the plate, small horizontal sheeves are fixed to the same frame work, shown at *r s*, fig. 2, which run against the upright edge of the plate. The body of the carriage can thus be moved readily back and forward along the plate rail. To prevent the boxes from moving, and to keep them steady upon the frame while the carriages are travelling, two catches, *g g*, are made use of, working upon a joint at one end, and resting upon the end of the frame work of the carriage, on the other. Carts, drawn by one horse, are used to convey one of those boxes from the rail-way through the streets. Plate rails, similar to those upon the rail-way carriage are fixed upon the frame work of the cart, so that when the cart is backed against the side of the rail-way carriage, with the plate rails of both forming a line, the boxes are easily run from off the rail-way carriage upon the frame of the cart; the empty ones being similarly transferred from the cart to the rail-way carriage.

Although the drawing shows only the form of boxes used for the conveyance of coals, yet it will readily occur that the form can be varied to suit the carriage of any kind of articles; the frame work, or body of the carriage being raised above the wheels, the breadth can be extended to any width which the distance between the rail-way will admit.

The body of the carriage is supported upon springs resting on the middle of the chairs of the axles; and the axles being projected beyond the sides of the frame work, the diameter at the bearing is consequently diminished; *t t*, *t t* are the springs resting on the chairs *i i*; the other end working upon plates of iron fixed to the frame of the carriage. *m m* are the guides that the chair works between, the extreme ends of which form a sort of cap projecting beyond the guides. The chair has a cover on the under side, to prevent the waste of oil, being screwed tight to the upper part, with a leather washer between. The oil is fed into the top of the chair, by a syphon wick, inclosed within a tin box, which holds a sufficient quantity of oil for supplying the axle for several hours; and by means of the syphon the oil is continually feeding upon the axle.

Observations on a new mode of constructing Harbours. By WILLIAM MATHESON, *Civil Engineer. Communicated by the author.*[*]

THE importance of good harbours to a mercantile country will be universally admitted, and the commercial eminence Great Britain has attained, has naturally directed the attention of persons interested in the extension of her trade, to the improvement of the surrounding harbours; and, perhaps, in no way have the skill and ingenuity of engineers been more extensively employed, or more usefully directed. Many great works have been executed at an enormous expense, and some of them have succeeded more or less, to the expectation of the parties.

---

[*] Read before the Royal Society of Edinburgh, 1831.

The erection of works within tide-mark must always be attended with trouble and additional expense, and it is the more to be lamented after such extensive operations have been carried into effect, that the whole benefit of them should be frustrated by some unforeseen circumstance, which has too frequently happened in such operations.

Of these latent difficulties, none has had a more powerful influence than the tendency of the tide, or the motion of the water in particular situations, to silt or sand up spaces which have been enclosed, and upon which, by means of such enclosures, a change has been made upon the currents.

This tendency to sand up is peculiar to every situation where quantities of sand are under the influence of the tide, or the motion of the waters, and liable to be carried from place to place in mechanical combination with the water, either by means of the ebbing and flowing of the tide, or of the motion given to it by particular currents; or, by, what is the most powerful of all, the motion given to it by the violence of the winds.

This motion of sand is generally in a direction opposite to that in which the wind is blowing, as may be seen in standing pools or lakes, where the sand, when the water is agitated by the wind, takes shelter under the banks of the weather side; but this will be more particularly explained afterwards.

In consequence of this tendency, the mouths of all rivers, and flat shores, and all bays and estuaries into which the tide rushes with violence, are more or less subject to the accumulation and shifting of sand banks, if sand is to be found in such situations. Examples of this may be seen by examining the harbours of Aberdeen, Dundee, Dublin, and a variety of others; and it may be generally asserted, that no harbour was ever erected upon a river, that was not more or less subject to the inconvenience of shifting sand banks at the mouth of the river, or of being itself sanded up.

The writer of these observations having been employed at an early period of life, in works connected with harbours, his attention was particularly directed, more than thirty years ago, to the annoyance met with by the sanding up of harbours; and he saw the object frustrated, after the most expensive works had been erected, in the hope that they would answer every purpose expected from them.

Never loosing sight of the evil which he had observed, nor ever ceasing to feel a desire to have it removed, he at last, by mere accident, discovered in the harbour of Pulteney Town, a circumstance which led him to a corrective theory upon the subject.

An opening had been left in the inner pier for upwards of a year, while the other operations of building were going on, and through which opening the receding tide, assisted by the land stream, passed into the harbour, and swept round, and again passed out at its mouth.

By this action of the tide, the harbour was kept perfectly free from any tendency to sand up; but in the course of a very short period, after the works were finished, and this opening closed up, in completing the harbour, the sand accumulated in it to such a degree as to make it inaccessible to vessels of even very small tonnage, and to cause the outlay of a large sum of money in the erection of an outer harbour which it is probable will be visited with the like obstructions, if they have not already taken place.

The practical hint thus afforded, induced the writer to form the idea of erecting the necessary works for sea harbours, with artificial openings, so constructed as to enable the waters still to retain their natural motion, and by that means to avoid eddies and stagnation, by the latter of which the sand and alluvion are deposited, and by the former of which the deposition is shifted and whirled from place to place.

His plan, therefore, may be very shortly described. Wherever it may be necessary to erect a harbour, or to extend the works of one in a situation where sand or alluvion may be likely to accumulate, he proposes, after laying a solid foundation of stone, to make the next range of buildings consist of a succession of arches of such a height of opening as not to disturb any class of vessels that may frequent the harbour, while they are protected and sheltered by the solid buildings erected over these arches, and at the same time, the openings shall be so proportioned to the depth of water, at the different points of the building, as to allow the tide to pass freely through.

To enter into any detail as to the particular mode of constructing the work, or of forming the arches, &c. is quite unnecessary here, as these must vary according to circumstances. It is enough, if it be admitted that walls with arches may be constructed under water, as well as solid walls: because so much being granted, it will appear sufficiently obvious that the motion of the tide, either in approaching or receding, will naturally pass through these arches, and carry with it both in advancing and retiring, whatever is mechanically united with it, and the agitation kept up upon the bottom of the harbour will prevent the sand being deposited.

There is another mode already hinted at, of sand being collected, which the peculiar construction of harbours here described is equally well calculated to counteract. It is a fact well known to some of those who attentively observe the operations of nature, that all floating substances, especially such as do not rise above the surface of the water, approach the shore with a land wind, and recede from it by a contrary wind. This seems to arise from the violence of the wind upon the water causing the surface water to pass from the shore, and the under water to approach it, to supply its place by means of an opposite current. This under current is the more conspicuous in its operation, when the tide flows or ebbs in a contrary direction to that of the wind, and the floating substances carried along are accordingly deposited.

The consequence is, that wherever large solid buildings are erected in a current of water, which has a tendency to sand up, and where these buildings pass along the shore, the wind from the shore that passes over them causes a sand bank to be formed seaward of the building, and to bring it directly into the mouth of the harbour, if it happens to be in the line of that building. This fact is strongly exemplified by the sand already accumulated at the back of the wet docks at Leith, or the stone pier at Newhaven, and in many other situations.—*Dr. Brewster's Journal of Science.*

On Perforating and Cutting Glass, Earthenware, &c.

Although many persons are acquainted with methods of perforating glass, &c. the following easy one, I find, is not so generally known as it deserves to be, and I am therefore induced to explain the mode of operating I employ, in order to produce the best results. Circumstances often conspire to render the process valuable to persons situated at a distance from large manufacturing towns, and especially to those who are living in places where they cannot readily obtain the various chemical apparatus they may require for their purpose. I have frequently found the knowledge to be of importance, not only as regards the time saved, (and time is equal to money,) but the facility with which the various broken and otherwise useless articles of domestic economy may be converted by its aid into convenient and useful chemical apparatus.

It will be unnecessary at present to enter into a detailed account of the various apparatus that may be constructed by any person acquainted with the process—it being my intention, on another occasion, to describe a variety of such arrangements. My present object is to describe the method by which the effect may be produced with certainty and despatch.

The only tools requisite in this process, are a few worn out three-edged handsaw files; these being generally made of cast steel, retain, when ground, a very fine point, which is of the utmost importance. In order, however, to give them the requisite degree of hardness, it is necessary to make their ends, for about an inch, red hot, and then plunge them into cold water; by this treatment they become hard and brittle; care is therefore required in grinding them to a proper point; this is easily effected on a common grindstone. I generally give them a few rubs on a fine oil stone after the grinding, so as to produce a very fine point.

A cylindrical piece of any sort of wood, about two inches long, terminated by a half round end, having a hole about the tenth of an inch in diameter through its axis, may either be fastened into a common bench vice, or on a table; this constitutes the only support required.

Suppose that a glass to cover the face of a wheel barometer is wanted, through which it is sometimes necessary to make a perforation for the purpose of passing the screw of the nonius through: a proper piece of glass being selected is to be marked with a dot of ink on the place where the intended perforation is to be made; the glass is then to be held horizontally by the left hand, on, and immediately over, the hole in the wood support above mentioned. A three edged file having been hardened, and ground to a fine point in the manner above described, is held firmly between the fore finger and thumb of the right hand, precisely in the position that a pen or pencil is retained when writing. The pointed steel is then to be repeatedly impinged against the glass over the spot intended to be perforated, taking care not to use too much violence; in a short time the outer surface is removed, and by a continuation of the process, a conical piece is forced from the under surface of the glass through the hole in the wood support; the perforation so produced, never exceeds in size a pin head, but may be made as large as required by holding it over the hole in the support, and working round its edge with a fine pointed file. In this way, after a little practice, and in a very few minutes, may be perforated with ease all descriptions of glass, from the thinnest crown to the thickest plate, without any danger. Indeed, I have frequently made four or five perforations in the space of an inch square, without any fear of starring the glass, as it is technically called.

When it is required to perforate glass globes, or the upper part of wine bottles, the wood support is of course unnecessary, as the figure of the vessel gives sufficient strength without it. Wine glasses or tumblers may also be easily perforated in a similar manner; but I mostly employ another process for them. These being made of a softer sort of glass, require only to be moved by the hand backwards and forwards in the manner of drilling, on the sharp point of the file, with the occasional assistance of a little oil and emery. Indeed, any sort of glass may be perforated in this manner with ease, but I think not so quickly as by the method of punching.

All the varieties of china and earthenware may be perforated by either of the above processes with certainty; and the ingenious experimentalist will find no difficulty in turning to account many otherwise useless articles by its assistance.

It may not be amiss to mention here an easy method, which I have occasionally employed with success, for separating the bottoms of phials from the other parts, &c.; I pour a small quantity of sand or emery into the angular turned up part of the vessel, with a few drops of water to moisten it; then by means of a piece of wood having a sharp point, I press the moistened sand, &c. into contact with the glass, and by gently turning the bottle round, bringing the point of the wood and the sand into contact with every part of the lower end of the phial in succession; by these means, the surface is quickly scratched, and immediately after a fracture takes place all round the bottle, which instantly separates the bottom; this effect does not take place with all sorts of bottles, but in very many it does.

J. Marsh.

[*Jour. Royal Institute.*

Meteorological Observations for October, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 9 P.M.	Barometer. Sun rise.	Barometer. 9 P.M.	Dew point.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	44°	66°	30.07	30.04	40	NW. S.	Moderate.		Clear day.
	2	52	72	29.94	29.90	52	SW.	do.		Clear—serene.
	3	68	76	.76	.73	62	SW.	do.		Fog—clear.
	4	60	78	.70	.62	61	NE. SW.	do.	.34	Fog—flying cl'ds—r'n n't
	5	50	61	.50	.50	57	W.	Breeze.		Cloudy—clear.
⊗	6	44	60	.70	.60	39	W.	Blustering.		Clear day.
	7	40	60	30.05	30.04	37	W. SW.	Moderate.		White frost—clear.
	8	50	69	.00	29.98	49	N. S.	Blustering.		Cloudy day.
	9	66	69	29.60	.60	65	SW. W.	Moderate.	1.00	Rain—cloudy.
	10	45	46	.64	.55	48	N. NW.	do.	1.30	Rain.
	11	40	46	.43	.50	40	N. W.	Blustering.	1.50	Rain.
	12	40	56	.80	.85	36	N. W.	do.		Clear day.
☽	13	35	64	.95	.82	30	NW. W.	Moderate.		Frost—clear.
	14	56	68	.80	.86	40	SW.	do.		Clear day.
	15	43	63	30.16	30.14	40	N. SW.	do.		Clear day.
	16	51	63	.14	.06	52	W.	do.		Fog—cloudy.
	17	38	75	.00	29.93	51	W. SW.	do.		Clear day.
	18	54	74	29.83	.80	50	W.	do.	.05	Clear day—rain in night.
	19	47	62	.86	.86	42	W. NW.	do.		Clear day.
	20	43	62	.95	.95	36	W.	do.		Clear day.
●	21	44	51	30.00	30.00	47	W.	do.		Clear day.
	22	51	66	.05	.05	49	SE. S.	do.		Fog—cloudy.
	23	59	74	.00	29.95	58	SE.	do.		Flying clouds—clear.
	24	56	62	29.72	.79	67	S. W.	Blustering.	1.90	Rain—clear.
	25	42	62	30.10	30.20	36	W.	Moderate.		Clear day.
	26	45	66	.20	.20	46	S. SSE.	do.		Foggy—clear.
	27	65	54	29.95	29.90	46	S. W.	Blustering.		Fog—rain.
☾	28	32	50	30.00	30.00	33	NW.	Moderate.		Clear day.
	29	34	54	.16	.20	33	N. NE.	do.		Clear day.
	30	40	56	.10	29.94	36	NW. E.	do.	.02	Clear day—rain in night.
	31	44	53	29.65	.60	46	NE. W.	do.		Cloudy—clear.
	Mean	48.58	62.52	29.90	29.87	46			6.71	

	Thermometer.	Barometer.
Maximum height during the month,	78. on 4th.	30.20 on 25th.
Minimum do. . .	32. on 28th.	29.43 on 11th.
Mean do. . .	55.55 . . .	29.88

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

DECEMBER, 1831.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Description of an apparatus, called the Rotascope, for exhibiting several phenomena, and illustrating certain laws of rotary motion. By WALTER R. JOHNSON.—*(With a Plate.)*

Our common books of mechanics generally contain concise accounts of the doctrines of rotary motion, limited for the most part, however, to the consideration of central forces, the centre of percussion and of gyration, and the centre of spontaneous rotation, to which may be added, the laws of oscillatory motion.

The forces tending to change the position of the axis of rotation are generally either wholly omitted, or if concisely stated in an abstract form, are apparently regarded as incapable of experimental illustrations. The whirling table of Mr. Ferguson is an ingenious apparatus for exhibiting the amount and direction of the several forces exerted by a body in its own fixed plane of revolution. But that instrument makes no provision for the phenomena above referred to.

When we consider that the extensive diffusion of a branch of knowledge, often depends on the facility with which its elements can be made apparent to the understanding, we are at no loss in estimating the practical value of philosophical instruments, whether intended for demonstration or for research. Of this truth the machine of Attwood may be taken as an illustration. This machine gives a most elegant and satisfactory exhibition of the principles of uniform, accelerated, and retarded motions, as dependant on the force of gravity.

All the motions in the machine may be so slow as to reduce the resistance of the air to an unimportant element, and the friction and inertia of the parts being separately determined and allowed for, the theoretical laws of motion are seen to be perfectly confirmed by the experiments.

As to the manner in which the principles of rotation have generally been explained, it may be briefly stated on the plan of what are called rectangular co-ordinates. As, by referring the effect of any force applied opposite to the centre of gravity of a body at rest, to three lines mutually crossing each other at right angles, the resulting direction which the centre of gravity of that body will take in free space, is inferred; so, by a consideration of three perpendicular axes of revolution within the body itself, we may determine the effect of any number of forces tending to produce rotation. Combining these two together we have the resultant motions both of rotation and translation. One of the most important propositions pertaining to the physical character of the subject, is that discovered and demonstrated by Frisi; that "when a body revolves on an axis, and a force is impressed, tending to make it revolve on another, it will revolve on neither, but on a line in the same plane with them, dividing the angle which they contain so that the sines of the parts are in the inverse ratio of the angular velocities with which the body would have revolved about the said axes separately."

The following are among the elementary experiments and observations which led to the construction of this instrument.

1. When we take up by its brazen meridian a common artificial globe, and, having given it a rapid motion about its axis, attempt to move the poles from their position, we shall find our efforts resisted, or the globe impelled in various directions, in a manner which will generally surprise those to whom the experiment is new. If the globe be held by the meridian, at points over the equatorial circle of the sphere, and the axis placed nearly vertical, and in this state of things the revolving globe be carried alternately from the right to left, and the reverse, by the extended arms as in a small orbit, or portion of an orbit, the tendency of the sphere to change the position of its axis will be felt in one or both directions of the movement.

2. There is in use a small apparatus for striking fire, composed of a semicylindrical box of tinned iron, a few inches in length, at one end of which is a small cavity for receiving the tinder, and above it is mounted, on an axis, a disk of steel to strike, when in rapid motion, upon a flint, held just above the tinder. The steel disk is put in motion by the friction of a string drawn briskly over a pulley on the axis. If, when the wheel in this apparatus, (which is about two inches in diameter,) is revolving vertically, we hold the whole loosely in the hand extended, and carry the latter alternately right and left before the body, so as to cause the wheel to describe a horizontal curve, to which the direction of its axis at the commencement of the motion is a tangent, we shall perceive a strong tendency in the wheel to leave the vertical and assume the horizontal position.*

3. A small apparatus, said to have been devised by the celebrated Laplace to illustrate the precession of the equinoxes, has been made in France, and imitated by an ingenious mechanic of Philadelphia.

---

* This neat little experiment had been made and was first communicated to me by Mr. William Mason, who, to render it the more striking, had mounted the whole box on a pointed axis passing longitudinally through the centre of gravity.

It is formed of two concentric rings revolving on axes at right angles to each other. Within the inner ring is a small spheroid, loaded at one of its poles in such a manner as to produce a rotation in the axis of the inner ring when the spheroid is caused to revolve with rapidity. The chief parts of the rotascope had been devised and constructed before I had an opportunity of seeing the above described apparatus.

4. A number of ingenious experiments were some time ago contrived and executed by Mr. Rufus Tyler, a skilful mechanician of Philadelphia, with an apparatus resembling, in some respects, the common *top;* included in a ring, and placed on a whirling table.

In that arrangement his experiments coincided to a certain extent with some of those which are presented with the rotascope on the orbit-rod.

There was wanting, however, the means of developing and exhibiting the causes which produce the changes which are actually seen to take place. This end is most important in whatever concerns the principles of mechanics. It is what constitutes the great beauty of Attwood's experiments, that the action of gravity is made to coincide, *in principle*, with its actual operation when unrestrained; while, at the same time, the bodies submitted to its action, move with velocities which can be readily followed by the eye.

The following description refers to the accompanying plate:—

A, is a fly wheel, about eight inches in diameter, formed in such a manner as to receive but slight resistance from the air. It is supported on the centre of a perfectly cylindrical axis about $\frac{3}{8}$ of an inch in diameter, terminated by cones to serve as pivot points, on which the wheel runs. The wheel is of brass, the axis of steel, one part, from the wheel towards the pivot, being polished, the other bronzed, for more readily distinguishing the changes of position. The wheel and its axis weigh about 2 lbs. 11 oz.

B, is the base or tripod of mahogany, which sustains the instrument.

F, is a wooden frame containing the principal moving parts of the apparatus.

1, 2, 3 are concentric metallic rings, each about $\frac{3}{4}$ of an inch in breadth, and about $\frac{2}{10}$ of an inch in thickness. The exterior one, (3,) being about fifteen inches exterior diameter, is sustained in its place by the screws *s*, *s*, which have their ends conically excavated to receive the pivot. The axis of the next ring, (2,) is at right angles to that of 3, and again the axis of 1, is at right angles to that of 2, and the axis of the wheel A, to that of the ring 1.

The centre of gravity of the wheel is likewise that of the whole system, and the axis of motion of each ring passes through that centre.

e, is a pivot to the vertical shaft *e*, *f*, upon which the frame F is supported, and upon which it may revolve. The axis of this shaft likewise passes through the centre of the wheel A.

f, is a socket and cone furnished with a tightening screw.

t, is a thumb-screw to fasten and hold the axis *e*, *f*, whenever it becomes necessary to prevent the horizontal motion of the frame F.

p, *p*, are two pulleys attached to the two upright pieces of the frame by metallic bands, and held fast, at any convenient height, on these supports by a screw on the back side; by taking out the screws *s*, *s*, the pulleys may be carried below the axis of the outer ring.

u, *u*, are nuts to keep in place the upper piece of the frame, and having a hole drilled through their heads to receive cords by which the whole frame may be suspended from the ceiling; and *h*, *h*, are two hooks for a similar purpose, and likewise for suspending other weights when not in use.

M, M, are weights acting as moving forces, to set the wheel A in motion. For these weights, the hand of the experimenter may, in many cases, be conveniently substituted, especially where it is not important to know the precise velocity attained. The cord is attached to the axis by means of the small projecting conical knob *k*, to which the centre of the cord is connected by doubling it, applying the pin to the double part, and then setting the wheel in motion to wind up the cord, so that one end will be drawn off from above, the other from below, and both tend to turn the wheel in the same direction.

c, *c*, are two cords connected with the axis of the ring 2, and passing over the pulleys *p*, *p*.

W, W, are weights attached to these cords.

z, indicates the direction in which those weights tend to turn the ring 2 about its axis. This direction is reversed by winding up the cord in the opposite direction.

w, *w*, are weights applied to pulleys firmly connected with the axis of circle 1, and tending to produce a rotation in the direction opposite to that indicated by *v*.

m, is a weight suspended or otherwise attached to the same circle, and tending to produce rotation in the direction of *v*.

x, denotes the direction in which the wheel will move when actuated by the forces M, M, as here represented; but by turning the wheel in the opposite direction, when the cord is applied over the knobs, it will be put in motion in the opposite direction, and the ring 2, will also move opposite to *z*, by the force of *m*.

O, is a bar of mahogany, called the orbit-rod, six feet in length, with a socket, by means of which it may, when the frame F is removed, be placed on the pivot *e*, and made to revolve. In this case the frame containing the wheel is to be set, or suspended, at one end, while at the other is suspended the weight C, which exactly counterpoises the frame and its appurtenances. This weight is placed below the bar in order to bring the centre of gravity as low as practicable, and produce a more stable equilibrium.

The following directions and cautions in using the rotascope will be found useful to those who may not be familiar with its action.

In winding up the *moving cord* around the axis of the wheel, it is necessary to keep the two ends as near to each other as practicable without having one *overlay*, or actually rub against, the other, and to have them wound from beginning to end of the spiral, parallel to each other, without crossings, as the latter will materially obstruct the uncoiling when the force is applied, and endanger the breaking of the cord.

Care should be taken that the uncoiling be made in such a position of the rings that the moving cord will free itself immediately from all contact with the wheel, at the instant it leaves the shaft.

The cords applied to the several pulleys on the first and second rings, should be kept closely wound round their respective pulleys when not wanted for immediate use; as they may otherwise become entangled in the wheel and obstruct its motion, or essentially endanger the accuracy and safety of the whole instrument.

In using the orbit-rod, the weights should be attached first, then the frame, F, put in its place, and finally, set upon the pivot *e*, when the base, B, will sustain the whole. The revolution should begin with a slow motion, and increase in velocity—all shocks and sudden changes of motion should be avoided.

When it becomes necessary to add any weights to the rings or other parts of the apparatus while on the orbit-rod, an equal weight should be added to the *counterpoise* to avoid lateral pressure on the pivot *e*.

When the *elementary particles* are placed on the axis, the changes of position of the rings should be made gradually, to avoid violent blows of the particles upon the ring 1; otherwise, they may bruise its edge, and be thrown off with violence.

When the wheel is to be stopped, it is most convenient and safe to do it by applying a moderate friction with the fingers to the axis.

To set the wheel in motion, apply the cord round the axis of the wheel, doubling it for that purpose, and putting the fold at the centre over the small pin near the end of the axis. Having wound up the cord, take one end in each hand, and draw the two ends apart with suitable force in directions at right angles to the axis, and as nearly as may be in the plane of the first circle, as well as parallel to the wheel itself.

The following are among the experiments which may be performed by the aid of the rotascope.

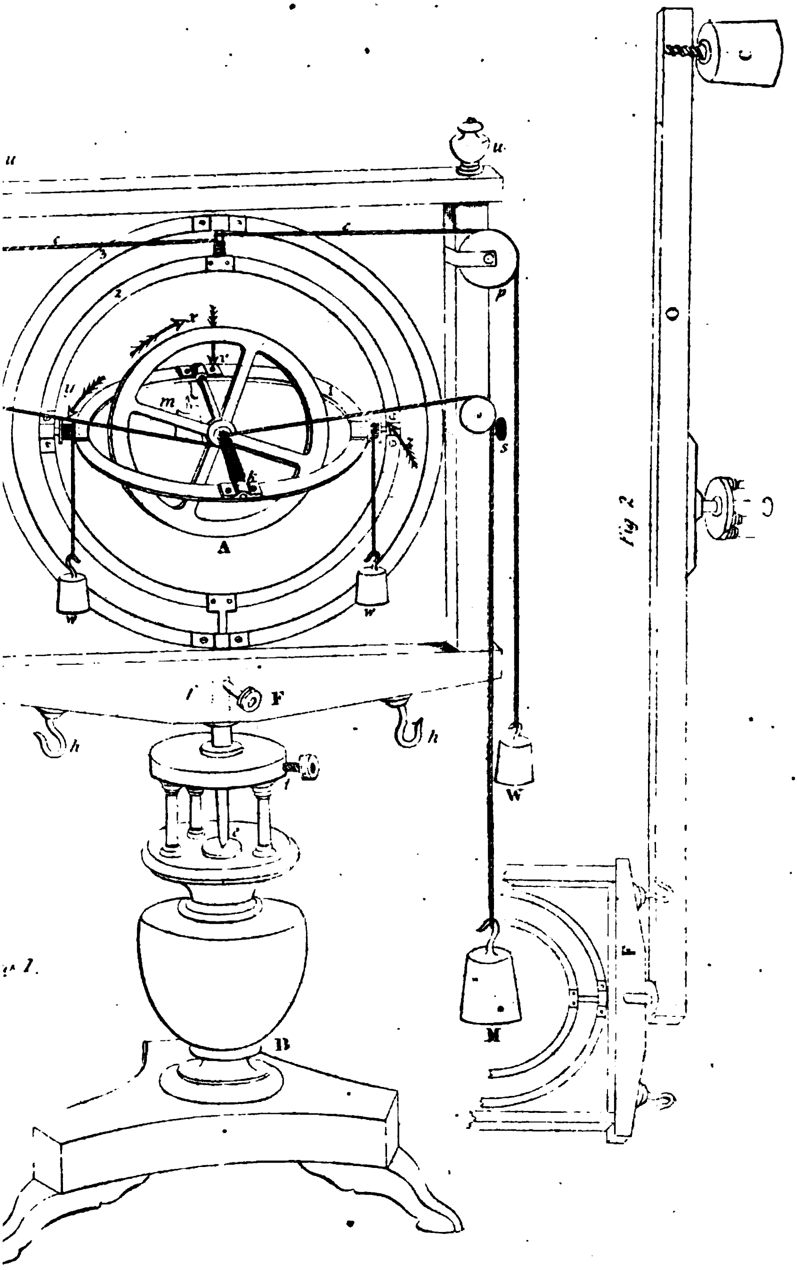
1. Take the wheel and its supporting circle from the frame. Connect with the ring, at a point opposite to the axis of the wheel, a wooden rod of sufficient strength to bear the weight when held horizontally, and from nine to twelve inches in length. Attach the end of this rod, remote from the wheel, to a cord suspended from the ceiling. Set the wheel in rapid motion, and then bring it up so that the rod shall be horizontal. Then suddenly abandoning it with the hand, the cord will sustain it, but instead of hanging vertically down, the axis of the wheel and rod, which may be regarded as its prolongation, will be kept for some time horizontal; but though thus suspended, as if by some mysterious agency, they constantly perform a circuit which has an *imaginary vertical* drawn from the point of suspension, for its axis. If the velocity of the horizontal revolution be diminished, the sustaining rod will incline downwards more rapidly than when left to itself, until at length it reaches the position of rest. But if the velocity of revolution be augmented by any external force, the wheel and ring will rise in opposition to gravity until the rim of the

wheel strikes the suspending cord. The wooden rod will then have come to a position nearly vertical, sustaining the wheel and ring at its upper end, but still continuing the horizontal motion. This paradoxical appearance, would continue the longer by having a delicate metallic swivel link in some part of the cord, which would prevent the twist that otherwise soon opposes the horizontal motion to such an extent as to depress the rod in the course of a few minutes. It will be seen that the revolution in a horizontal direction, being the resultant of gravity, combined with the rotary motion of the wheel, must become more rapid in proportion as the velocity of the latter on its axis is diminished: because the force of gravity is then a greater component in the combined forces which act upon the system.

2. Having replaced the wheel and ring, in their connexion with the frame, set the latter on its pivot upon the base, B. Make the circle, or ring, 3, fast in a vertical position, apply cords to the pulley on the axis of ring 2, and bringing the pulleys *p*, *p*, to a proper elevation; make them fast, and pass those cords over them to sustain weights. Having given the wheel a rapid motion, take hold of one of the urns *u*, *u*, and cause the whole frame to revolve horizontally on its pivot. As the persistency of the wheel in the plane of its motion prevents the ring 2 from revolving, the motion of the frame will gradually wind up the cords about the pulley. At the same time, however, the ring 1 will gradually change its plane, and bring the wheel to a position to obey the action of the weights. The portion of cord which had been previously wound about the pulley will then be uncoiled, and a considerable momentum communicated to the system composed of the rings 1 and 2, which will, if the tightening screw, *t*, be made fast, again wind up the cord in the opposite direction about the pulley. As soon as the said rings, however, are again deprived of their momentum by the action of the weights, the latter will again tend to produce a rotation in the ring 2, which will be opposed by the persistency of the wheel. If, at this moment, the pivot be released from the screw, the whole system, composed of the two weights, the frame, and ring 3, will be made to revolve by the gravity of the weights, while the ring 2 remains pertinaciously fixed in its position, until the wheel has had time again to invert its axis. This time will be greater or less according to the greater or less velocity of rotation in the wheel, compared with the size of the weights hanging over the pulleys.

3. Set, or suspend, the frame on the orbit rod. Give the wheel a moderate velocity of rotation, and set the whole in motion upon the pivot *e*, all the circles being free to move on their respective axes. In whatever direction the wheel revolves, with respect to the plane of the orbit, at the commencement of the *orbicular* revolution, it will soon be observed to conform in direction to the latter. If *this* be reversed, *that* will soon be reversed also.

4. Repeat the third experiment with only the addition of a weight of eight ounces attached to the second circle, opposite to the axis of the first. The effort of the wheel to take and maintain in its rotation the direction of this orbicular motion, will be sufficient to keep the weight elevated nearly to a level with the centre of the wheel.



ROTASCOPE BY W. R. JOHNSON.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a Moving Power.

(Continued from p. 305.)

TABLE I.—PART I.

CHUTE No. 5.—*Elbow buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	7.75	9.33	10.41	1.50	566	48.95	614.95	41.5	33	11.84	5425	14.75	800187	255204	.319			
2					669	50.58	719.58		36	10.86	6075		896062	298624	.333	.333	10.86	
3					772	52.21	824.21		42	9.31	7025		1036187	342046	.330			
4					875	53.84	928.84		49	7.98	8175		1206812	385468	.319			
5	7.00	8.58	9.66	1.50	566	48.95	614.95	51.5	34	11.50	5505	14.00	770700	255204	.330			
6					669	50.58	719.58		38	10.28	6230		872200	298624	.342	.342	10.38	
7					772	52.21	824.21		44	8.88	7225		1011500	342046	.338			
8	7.00	8.58	9.66	1.75	566	48.95	614.95	41.5	32	12.20	5350	14.00	749000	255204	.340			
9					669	50.58	719.58		34	11.50	5925		829500	298624	.359			
10					772	52.21	824.21		39	10.02	6735		942900	342046	.362	.362	10.02	
11					875	53.84	928.84		45	8.71	7880		1103200	385468	.349			
12					978	55.47	1033.47		51	7.66	8880		1243200	428889	.345			
13	6.00	7.58	8.66	1.50	566	48.95	614.95	41.5	40	9.77	5700	13.00	741000	255204	.344			
14					669	50.58	719.58		41	9.54	6300		819000	298624	.364	.364	9.54	
15					772	52.21	824.21		49	7.98	7525		978250	342046	.349			
16	6.00	7.58	8.66	1.75	669	50.58	719.58	41.5	37	10.57	6075	13.00	789750	298624	.378	.378	10.57	
17					772	52.21	824.21		44	8.88	7050		916500	342046	.373			
18					875	53.84	928.84		50	7.82	8230		1069900	385468	.360			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE L.—PART II.

CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Secds.	Feet.	Lbs.	Feet.						
19	6.00	7.58	8.66	2.00	566	48.95	614.95	41.5	31	12.60	5400	13.00	702000	255204	.363			
20					669	50.58	719.58		35	11.16	5950		773500	298624	.386	.386	11.16	
21					772	52.21	824.21		40	9.77	6950		903500	342046	.378			
22	5.00	6.58	7.66	1.25	566	48.95	614.95	41.5	46	8.50	5850	12.00	702000	255204	.363	.363	8.50	
23					669	50.58	719.58		56	6.98	7165		859800	298624	.347			
24	5.00	6.58	7.66	1.50	669	50.58	719.58	41.5	46	8.50	6490	12.0	778800	298624	.383	.383	8.50	
25					772	52.21	824.21		55	7.10	7950		954000	342046	.359			
26	5.00	6.58	7.66	1.75	772	52.21	824.21	41.5	49	7.98	7510	12.00	901200	342046	.379	.379	7.98	
27					875	53.84	928.84		58	6.74	8580		1029600	385468	.374			
28	5.00	6.58	7.66	2.00	669	50.58	719.58	41.5	39	10.02	6135	12.00	736200	298426	.405	.405	10.02	
29					875	53.84	928.84		54	7.24	8425		1011000	385468	.381			
30	4.00	5.58	6.66	1.00	360	46.61	406.61	41.5	46	8.50	4525	11.00	497750	168743	.339			
31					463	48.48	511.48		54	7.24	5350		588500	212264	.360	.360	7.24	
32					566	50.35	616.35		68	5.75	6500		715000	255785	.357			
33	4.00	5.58	6.66	1.50	463	48.48	511.48	41.5	38	10.28	5050	11.00	555500	212264	.382			
34					566	50.35	616.35		43	9.09	5675		624250	255785	.409	.409	9.09	
35					669	52.22	721.22		52	7.52	6800		748000	299306	.400			
36					772	50.09	826.09		64	6.10	8350		918500	342827	.373			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE L.—PART III.

CHUTE No. 5.—*Elbow buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
37	3.00	4.58	5.56	1.50	463	48.48	511.48	41.5	41	9.54	5000	10.00	500000	212264	.425			
38					566	50.35	616.35		49	7.98	5800		580000	255785	.441	.441	7.98	
39					669	52.22	721.22		57	6.86	6900		690000	299306	.433			
40	3.00	4.58	5.66	1.75	566	50.35	616.35	41.5	44	8.88	5575	10. 0	557500	255785	.459	.459	8.88	
41					669	52.22	721.22		52	7.52	6650		665000	299306	.450			
42					772	54.09	826.09		64	6.10	8100		810000	342827	.423			
43	3.00	4.58	5.66	2.00	566	50.35	616.35	41.5	42	9.31	5500	10.00	550000	255785	.465	.465	9.31	
44					669	52.22	721.22		51	7.66	6700		670000	299306	.447			
45	2.00	3.58	4.66	1.00	257	44.74	301.74	41.5	51	7.66	3125	9.00	281250	125222	.445			
46					360	46.61	406.61		66	5.92	4025		362250	168743	.466	.466	5.92	
47					463	48.48	511.48		85	4.60	5225		470250	212264	.451			
48	2.00	3.58	4.66	1.25	257	44.74	301.74	41.5	40	9.77	3800	9.00	342000	125222	.366			
49					463	48.48	511.48		60	6.50	5175		465750	212264	.455	.455	6.50	
50					566	50.35	616.35		67	5.84	6450		580500	255785	.440			
51					669	52.22	721.22		81	4.83	7675		690750	299306	.433			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE L.—PART IV.

CHUTE No. 5.—*Elbow buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Head of Water above. Top of bkt.	Head of Water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
52	2.00	3.58	4.66	1.50	360	46.61	406.61	41.5	42	9.31	4350	9.00	391500	168743	.431			
53					463	48.48	511.48		50	7.82	5150		463500	212264	.458			
54					566	56.35	616.35		59	6.62	6150		553500	255785	.462	.462	6.62	
55					669	52.22	721.22		72	5.43	7425		668250	299306	.448			
56	2.00	3.58	4.66	1.75	463	48.48	511.48	41.5	45	8.71	5125	9.00	461250	212264	.460			
57					566	50.35	616.35		55	7.10	6025		542250	255785	.471	.471	7.10	
58					669	52.22	721.22		66	5.92	7250		652500	299306	.459			
59					772	54.09	826.09		78	5.01	8600		774000	342827	.443			
60	2.00	3.58	4.66	2.00	463	48.48	511.48	41.5	45	8.71	5075	9.00	456750	212264	.464			
61					566	50.35	616.35		54	7.24	6000		540000	255785	.473	.473	7.24	
62					669	52.22	721.22		64	6.10	7150		643500	299306	.465			
63	1.00	2.58	3.66	2.00	360	46.61	406.61	41.5	53	7.38	4000	8.00	320000	168743	.527			
64					463	48.48	511.48		65	6.00	4930		394400	212264	.539	.539	6.00	
65					566	50.35	616.35		82	4.77	6025		482000	255785	.530			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE M.—PART I.

CHUTE No. 5.—*Centre buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	7.75	9.33	9.33	1.00	257	44.06	301.06	41.5	30	13.00	3675	14.75	542062	124950	.230			
2					360	45.69	405.69		33	11.84	4125		608437	168361	.276			
3					463	47.32	510.32		38	10.28	4625		682187	211782	.310			
4					669	50.58	719.58		48	8.14	5050		862875	298624	.345			
5					772	52.21	824.21		53	7.38	6500		958750	342046	.356	3.56	7.38	
6					875	53.84	928.84		61	6.40	7425		1095187	385468	.351			
7					978	55.47	1033.47		75	5.21	8775		1294312	428889	.331			
8	7.75	9.33	9.33	1.25	669	50.58	719.58	41.5	37	10.56	5475	14.75	807562	298624	.368			
9					772	52.21	824.21		40	9.77	6050		892375	342046	.383			
10					875	53.84	928.84		44	8.88	6685		986037	385468	.390	.390	8.88	
11					978	55.47	1033.47		50	7.82	7525		1109937	428889	.386			
12					1081	57.10	1138.10		56	6.98	8450		1246375	472310	378			
13	7.75	9.33	9.33	1.50	772	52.21	824.21	41.5	35	11.16	5820	14.75	858450	342046	.398			
14					875	53.84	928.84		38	10.28	6375		940312	385468	.410			
15					978	55.47	1033.47		43	9.09	7050		1039875	428889	.412	.412	9.09	
16					1081	57.10	1138.10		47	8.32	7875		1161562	472310	.407			
17	7.75	9.33	9.33	1.75	875	53.84	928.84	41.5	37	10.56	6250	14.75	921875	385468	.418			
18					978	55.47	1033.47		38	10.28	6725		991937	428889	.432	.432	10.28	
19					1081	57.10	1138.10		42	9.31	7500		1106250	472310	.427			
20					1184	58.73	1242.73		46	8.50	8325		1227937	515733	.420			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE M.—PART II.

CHUTE No. 5.—*Centre buckets. Close Breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	5.00	6.58	6.58	0.75	463	47.32	510.32	41.5	56	6.98	4830	12.00	579600	211782	.365			
22					566	48.95	614.95		67	5.84	5700		684000	255204	.373			
23					669	50.58	719.58		86	4.54	6600		792000	298624	.377	.377	4.54	
24	5.00	6.58	6.58	1.00	566	48.95	614.95	41.5	48	8.14	5375	12.00	645000	255204	.395			
25					669	50.58	719.58		55	7.10	6050		726000	298624	.411			
26					772	52.21	824.21		63	6.20	6885		826200	342046	.414	.414	6.20	
27					875	53.84	928.84		72	5.43	7950		954000	385468	.404			
28					978	55.47	1033.47		84	4.65	9215		1105800	428889	.387			
29	5.00	6.58	6.58	1.25	669	50.58	719.58	41.5	44	8.88	5775	12.00	693000	298624	.430			
30					772	52.21	824.21		48	8.14	6460		775200	342046	.441			
31					875	53.84	928.84		55	7.10	7265		871800	385486	.442	.442	7.10	
32					978	55.47	1033.47		62	6.30	8250		990000	428889	.433			
33	5.00	6.58	6.58	1.50	772	52.21	824.21	41.5	43	9.09	6250	12.00	750000	342046	.456			
34					875	53.84	928.84		49	7.98	7000		840000	385468	.458	.458	7.98	
35					978	55.47	1033.47		55	7.10	7875		945000	428889	.453			
36	5.00	6.58	6.58	1.75	772	52.21	824.21	41.5	40	9.77	6200	12.00	744000	342046	.459			
37					875	53.84	928.84		45	8.70	6800		816000	385468	.472	.472	8.70	
38					978	55.47	1033.47		50	7.82	7660		919200	428889	.461			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE M.—PART III.

CHUTE No. 5.—*Centre buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
39	2.00	3.58	3.58	0.75	257	44.74	301.74	41.5	62	6.30	3025	9.00	272250	125222	.460			
40					360	46.61	406.61		78	5.01	3955		355950	168743	.474	.474	5.01	
41					463	48.48	511.48		105	3.72	5200		468000	212264	.453			
42	2.00	3.58	3.58	1.00	360	46.61	406.61	41.5	51	7.66	4200	9.00	378000	168743	.446			
43					463	48.48	511.48		62	6.30	5000		450000	212264	.471			
44					566	50.35	616.35		71	5.30	5840		525600	255785	.486	.486	5.50	
45					669	52.22	721.22		83	4.71	6850		616500	299306	.485			
46					772	54.09	826.09		102	3.83	7900		711000	342827	.482			
47	2.00	3.58	3.58	1.25	463	48.48	511.48	41.5	51	7.66	4850	9.00	436500	212264	.486			
48					566	50.35	616.35		58	6.74	5555		499950	255785	.511			
49					669	52.22	721.22		68	5.75	6450		580500	299306	.516	.516	5.75	
50					772	54.09	826.09		77	5.07	7450		670500	342827	.511			
51					875	55.96	930.96		88	4.44	8640		777600	386349	.496			
52	2.00	3.58	3.58	1.50	566	50.35	616.35	41.5	53	7.38	5450	9.00	490500	257785	.525			
53					669	52.22	721.22		62	6.30	6260		563400	299306	.531	.531	6.30	
54					772	54.09	826.09		71	5.50	7225		650250	342827	.525			
55					875	55.96	930.96		82	4.77	8340		750600	386349	.515			
1	2	3	4.	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

Continued from p. 315.

(No. XI.)

Letter from L. Hebert, Esq., of London, in reply to the Circular of the Committee of the Franklin Institute.

20 *Paternoster Row*, *London*, 12 *October*, 1830.

Although I cannot have the satisfaction of furnishing you with any very important evidence on the subject, which the committee of your valuable institution have so laudably undertaken to investigate; yet, with the hope that the addition of my "mite," may tend in some degree to promote the object you have in view, I venture to give you a brief detail of my limited experience and observation; to which I shall take leave to add a few suggestions for improving the apparatus connected with the generation of steam.

It has never fallen to my lot to be present during the explosion of an *ordinarily constructed* steam-engine boiler, but I have seen the condition of several immediately, or soon after, that occurrence, and have obtained information upon which I can rely, respecting many of the circumstances attending them. I have, however, "stood fire" several times in the experimental disruption of tubular boilers, from a conviction of their innocuous effects, which I shall more particularly notice in the course of this letter.

With respect to the common capacious boilers, the first instance I shall mention was that of a long cylindrical boiler, distinguished in England by the name of Trevithick, as the presumed inventor,[*] in which three separate burstings took place in precisely the same part of the boiler;—in that part immediately above the strongly ignited fuel of the furnace, and extinguishing the fire each time, but without causing any further material damage: the pressure in each case being upwards of fifty pounds upon the inch. The boiler was made of the best malleable iron. Previous to the disruption there was observed a bulging, or swelling out, of the metal, which gradually increased till it became nearly of a hemispherical figure, when it burst open and let the water out of the boiler into the fire. The boiler was repaired by putting a thick patch of malleable plate iron over the hole, when, after about six weeks wear and exposure to the fire, this metal bulged out again, and burst asunder; a third patch was substituted, and in about a similar period of time, was destroyed in the like manner. As the third disaster might naturally be expected from the results experienced in the first and second, it is proper to notice that the urgent wants of the manufactory were such as to render it expedient to get the engine into working order, notwithstanding that circumstance. The cause of these ruptures appeared upon investigation to be owing to a partial and very intense heat impinging against that particular spot where they took place. A positive proof of this might very likely have been afforded by an alteration in the flue, but the working of the engine was, after the last accident, discontinued. This boiler was not set with the furnace in its usual situation, but underneath it, at one end; the heated air and flame, consequently, after impinging against the bottom, suddenly turned off at right angles to the remotest end of the boiler where it first entered the internal flue, and the air for combustion was supplied by means of what the masons here call an *air-drain;* consisting of a narrow subterraneous channel leading from the external atmosphere, (that is, outside of the building,) into the ash pit, where it terminated in a small opening near to, and directly under, the furnace bars; consequently, producing the effect of a continuous blast upon that part of the boiler where the current of air first impinged.

---

[*] I am inclined to think that your countryman, Oliver Evans, was the earliest inventor of this long boiler; if so, the merit of our justly celebrated Trevithick, will, in *this* instance, be merely that of having spoiled "a good original," by his having increased the diametrical proportions of the cylinder.

I am strengthened in this opinion by the information derived from a friend, that Mr. John Martineau, (a respectable engineer of London,) had a boiler which was twice destroyed in the same spot; upon endeavouring to ascertain the cause, Mr. Martineau discovered a fissure in the brick-work exactly opposite that part of the boiler where the ruptures took place; through this fissure the air rushed with great impetuosity, producing the effect of a blow-pipe upon the metal.

By a reference to the description of the boiler adopted by Messrs. Braithwaite and Ericsson, (inserted in the "Journal of the Franklin Institute,") in the "Novelty" steam carriage, it will be perceived that that part of their boiler where the flue first takes a horizontal course is exceedingly exposed to the destructive influence of the fire, especially when the strong blast they employ is superadded. For having pointed out the imminent risks of explosions incurred by this arrangement of the flue, my motives were impugned and misrepresented; although my intention was chiefly to show the cause of an acknowledged effect, that might have been attended with very serious disaster. My reason for mentioning this circumstance here, is, that as Messrs. Braithwaite and Ericsson's boiler has been trumpeted forth by the British press, generally, as a perfect model for imitation, it may come under the notice of your committee, who will probably decide, whether the arrangement of the parts, (however excellent in some respects,) is not calculated to cause an early disruption of that part of the boiler, where the flue first takes a horizontal course? I beg leave also to submit an opinion to your committee, that in forming the flues of steam boilers generally, all sudden bends should be avoided as dangerous, especially such as cause the current of flame and heated gases to strike partially against the boiler; and if a blowing apparatus be used, that the air should be uniformly distributed over the ash-pit, before it reaches the furnace bars;—and in the case of using an exhausting apparatus in the chimney, the same attention should be paid to a uniform distribution of the air, so as to avoid all partial currents.

Although boilers that are constructed with flues running through them, seem to be well contrived for economising heat, (and it is on this account, I conjecture, that they have received so general a preference,) there results from this arrangement a source of danger, from the deposit of soot becoming ignited. I make no doubt that many boilers have been destroyed owing to this circumstance, and I can instance one case in which this was *ascertained* to have been the cause: it was that of a high pressure boiler at Adams' Forge, Wednesbury, in Staffordshire, which exploded a few years ago, killing the proprietor, Mr. Adams, and five of his men, besides dreadfully injuring six other persons. The steam in the boiler was at the usual working pressure of sixty pounds, the safety valve was in good order, and there was plenty of water in the boiler. The flue from the furnace, before entering the chimney, passed through the steam chamber in the upper part of the boiler, where a quantity of soot was collected, which having been ignited, caused the surrounding metal to become red hot. In consequence, so sudden and powerful an expansion of the high pressure steam took place, as to render the aperture of the safety valve inadequate to carry off the steam as fast as it was generated, and the catastrophe ensued. The boiler, although formed of the best malleable iron plates, was separated into about fifty parts, which were scattered in all directions and to great distances. This single fact seems to me to place the *danger* of such an arrangement of parts in a pretty clear point of view, and I think we may therefore safely conclude that the plan is at least ineligible.

I shall now, sir, mention a fact that came under my observation, which shows the unfitness of boilers of large capacity or surface being employed for locomotive purposes, (wherein the steam is of no practical use, unless of very great elastic force,) and likewise the positive necessity of having a *principal* safety valve placed out of the control of the attending engineer, who is, naturally, very apt, (as I have had occasion frequently to notice,) to become excited at a moment of difficulty to do very imprudent things.

About three years ago, I was invited to attend an excursion of Messrs. Burstall and Hill's locomotive steam coach, from Lambeth, near London, but I declined being present, expressing my fears of the safety of the boiler. Several of my acquaintances, who did attend, were brought home wounded from the explosion of the boiler, and one of them nearly fatally by a large piece of the boiler striking him, and he was necessarily deposited in the nearest hospital. The wheels of the carriage had got into some loose ground, and the power of the engines appearing inadequate to extricate them, the engineer leaned with his weight upon the safety valve to get an accumulation of power for the purpose. At this time the boiler gave, to the persons surrounding the machine, alarming indications of its weakness, which induced many of them to retire from it; but a friend of mine who was behind it, had the boldness to advance and throw wide open the furnace door; the act was barely completed when the explosion took place, and he was both lacerated and scalded; none were "killed-off," (to use the *humane* expression of one of our now killed-off Ministers of War.) This boiler, like the last mentioned, was made of the best wrought or malleable iron, yet it flew into *pieces*, in spite of those wiseacres who assert that boilers of such iron "only *tear* open."

It was of a circular figure, very shallow, with a dome top, the interior being braced together by iron bars, upon the principle of trussing roofs in architecture.

The most frequent cause of disaster, has been, I believe, a deficiency of water in the boiler, owing to the failure, or imperfect action of the pumps. Several instances of this have come to my knowledge, but I am not in possession, at present, of the particular circumstances attending them, and shall therefore only mention one; which was that of a wrought iron boiler, with a spherical top, of Boulton & Watt's construction, employed at Aston Forge, near Birmingham. In this case it was ascertained that the explosion was caused by the boiler becoming red hot, into which the water was subsequently injected by the force pump, producing so instantaneous and powerful a volume of steam, as to overcome the resistance of the vessel.

Your committee is doubtless fully acquainted with all the facts that have appeared in print, respecting the explosion of steam boilers in this country. I allude, in particular, to the evidence given before committees of the British House of Commons appointed for that purpose.

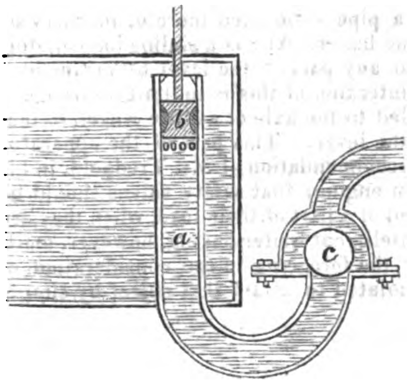
Although the fates have never permitted me to be present during the explosion of a *common* boiler, (by which I mean all those having vessels of large capacity,) they have allowed me repeatedly to gratify my curiosity by observing the innocuous effects of the bursting of the small distinct chambers of tubular boilers, produced by the forcing of water into them, when the metal was at a bright red, or approaching to a white, heat. The explosion, though alarming to a stranger at first, from the noise and violent ejection of the vapour, is such as to give him confidence to "stand fire" in subsequent experiments. In all those that I witnessed, a *rending* of the metal was uniformly produced, of from one to three or four inches in length, and it usually occurred in that part of a tube where the welding had been more or less imperfectly performed, or where, from other causes, the metal was reduced in thickness. The internal diameter of the tubes in question was barely one inch, the thickness three-sixteenths, generally, but in the weakest places about an eighth of an inch. Although the force of steam to produce such effects might safely be estimated at several hundred pounds upon the inch, as a minimum, the maximum cannot be ascertained without knowing how far the tenacity of the metal was impaired by the great heat to which it was subjected. But such results as attended the bursting of those tubes demonstrated, that under no circumstances of neglect on the part of the engineer, (or even of malicious intent, supposing that to be possible,) or of accidental derangement in the supply pump, or of the safety valve, &c., is any personal danger, whatever, incurred by the use of boilers made with them.

In the case of a boiler of the ordinary proportions and capacity becoming red hot by the temporary suspension of the supply of water, which is afterwards renewed, the destructive effect of an explosion, as compared with that of the tubular boiler before mentioned, would be in the exact proportion of its increased diameter; hence, the consequences, as respects the scalding water, would be as the area of their respective sections, the length being presumed to be the same in both cases. If, therefore, we consider the area of the inch tubes as .785, and estimate the diameter of a common boiler to be 24 inches only, this gives an area of 452.39 inches; consequently, (as will be found upon calculation,) there would be ejected, by an explosion of the latter, 576 times the quantity of water of the tubular boiler, and with a greatly increased momentum. In reply to this, it might be stated that the whole contents of the tubular boiler would be discharged through the fissure opened; but supposing that no provision were made to prevent such a consequence, the jet of water would be nearly like that of a small fountain; whereas, in the large vessel of the common boiler, the accumulated force would produce a sudden and instantaneous irruption of the whole contents, almost in a body, besides projecting great pieces of metal about. It is worthy also of particular notice, that as the comparative safety of boilers is in the inverse ratio of their diameter, the 24 inch boiler must be 24 times as thick as the inch tubular boiler, to sustain the same pressure; that is 4½ inches thick! It is needless to remark, that a boiler of such a thickness would be worse than useless, supposing it practicable to make it.

As the heating of boilers *uniformly* over their surfaces is an object of the utmost importance, your committee will probably think that the plan of heating, patented and adopted by Messrs. Beale and Porter, of London, is worthy of their attentive consideration. It consists in communicating the heat from the furnace through the medium of a surrounding bath, containing a fluid that requires a higher temperature to vapourize it than water; and by varying the composition of the fluid medium, according to the temperature required in the steam, no excess of heat in the engine boiler can take place; nor can any surplus caloric be retained in the bath, as an open pipe proceeds from it to the atmosphere, to carry off whatever vapour may be there produced. The engine boiler is thus protected from any heat that can injure the tenacity of the metal, which need not be of much more substance than is necessary to sustain the working pressure in the boiler. These are the leading advantages set forth by the patentees; but the real merits of the plan, whatever they may be, will, I make no doubt, be duly examined and estimated by your intelligent committee. (An account of Messrs. Beale and Porter's plan for heating high pressure boilers will be found at page 39, vol. V., N. S. of the "Register of Arts and Journal of Patent Inventions.")

One of the fruitful causes of explosions in high pressure steam boilers has been the imperfect action of the force pumps, owing to some derangement of the valves, which they are extremely liable to, on account of the strains to which they are subjected. For this reason the utmost possible simplicity of parts, and the most solid and accurate workmanship, are indispensable. Fine particles of sand insinuating themselves between the surfaces that move in contact very soon render the pumps unserviceable; to prevent which it is highly desirable to use *filtered* water; and the cistern into which the filtered water is delivered, should, I think, have at least two pipes of communication with the "service pipe," and each of the two pipes should contain a moveable box, in which are properly packed the filtering substances, so that either of them may be renewed at pleasure, without impeding the operation of the other. The cocks and union joints required to render this process convenient, are too obvious to need mentioning. Whilst I am writing, a thought occurs to me, of which possibly something may be made by the ingenious members of your committee; but as I am somewhat dubious of its practicability myself, I put the idea down in the form of a question.—Could not the filtering boxes just mentioned be so arranged as to be rendered *chemically*, as well as mechanically, subservient to the purification of the water,—supposing the filtration to be performed by ascension, and the first, or lowest, stratum of matter, whether solid or fluid, passed through, to be composed of one or more chemical agents, adapted to precipitate the principal matters held in solution by the water? Would not the water thus purified, prevent deposits in the boiler, from whence it is so difficult and troublesome to dislodge it by the ordinary practice? It would surely be much easier to abstract the foreign matter obtained by the first process, in the boxes, than by the last, of evaporation, in the boiler; and I submit that it had better be only partially done, than not at all. The stratum of earthy matter that usually forms and adheres to the bottoms and sides of boilers, not only causes a great loss of heat, or *waste of fuel*, but by interposing a non-conducting substance between the metal and the water, the fire acts very *destructively upon the metal.* Every member of your committee is, I am persuaded, fully aware of these circumstances, and I only introduce a notice of them here, that they may not escape their attention during their important investigation.

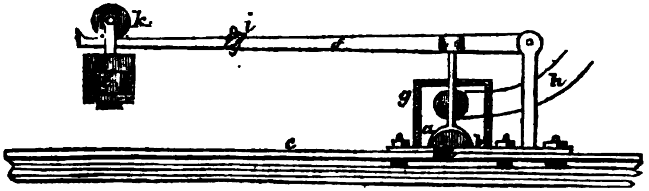
With respect to force pumps, so sensible am I of the advantages of simplicity and strength, that I have been led to give a preference to a force pump suggested by Sir James C. Anderson, (in a conversation I had with him on their common defects,) although it works against the pressure of the atmosphere in its up-stroke; of this pump I annex a sketch that I trust will be sufficiently explanatory.



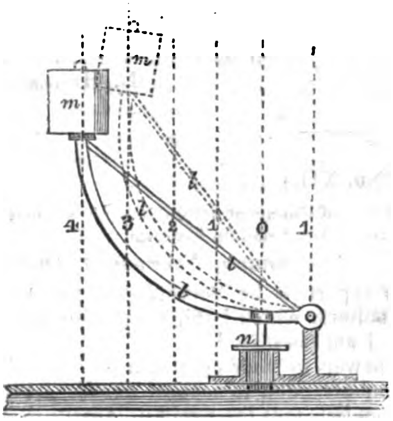
The water enters through the perforations in the tube *a*, when the plunger, *b*, is lifted into the position represented; and when the plunger makes the return stroke, a metallic ball, *c*, is raised, and a quantity of water, equal to that contained in the tube between the perforations and the lowest point of the stroke, is discharged into the boiler. The ball being forced against its seat by the pressure of the steam, prevents the return of the fluid, and as there is no induction valve, (in the common meaning of the term,) the water cannot be driven back through it, (when out of order,) into the supply cistern, which I have often observed to be the case in common pumps. The power lost by the up-stroke of the pump is not more than a 200th part of that of the engine, which was considered as of less importance than the insuring of a regular supply of water to the boiler. I do not, however, consider it as a perfect machine, and I notice it merely that your committee may give the intention, rather than the plan, their attention.

In the application of revolving cocks for feeding high pressure boilers, I consider it as absolutely necessary that the water should be filtered, provided it contains siliceous, or other hard, sandy particles, which are particularly destructive to apparatus of this kind. Revolving cocks were applied by your ingenious countrymen, Mr. Jacob Perkins, and Mr. Joseph Eve; but how far they have succeeded in rendering their action preferable to force pumps, I have not had the opportunity of learning.

With respect to obtaining increased security from safety valves, I have two or three plans to submit to the consideration of your committee; annexed is a sketch of one of them.



At *a* is intended to be represented a metallic cap, inverted, whose edge is to be nicely turned, so that its periphery may lie in a true horizontal plane, upon a flat hard steel plate, *b*, fixed to the top of the boiler, *c*; the hole at *d*, is made much larger than usual, (to allow the steam to escape quicker,) requiring, in consequence, a heavier weight, *e*, or a lever, *f*, of greater effect to keep the cup to its seat; *g* is a box to receive, and *h* a pipe connected thereto, to carry off the steam that escapes from the boiler. At *i* is a sliding loop or stop, which is fixible at pleasure on any part of the lever by means of a finger-and-thumb screw; the intention of this is to limit the range of the weight *e*, which is suspended to the axle of a little wheel, *k*, that runs upon the upper edge of the lever. This part of the apparatus was devised from noticing a recommendation of Mr. Tredgold, in his excellent treatise on the steam engine; that safety valves should be so constructed as to be relieved of a part of their load, when they are raised by the steam. That intelligent writer having, however, omitted to give any plan, I submit the foregoing to the consideration of your committee, as being calculated to attain that object by simple and efficient means.



Although this valve may be found advantageous as applied to land, or fixed, engines, your committee will immediately perceive its ineligibility for steam-boats, the lurching of which would prevent the weight from acting always in the manner desired. To obviate this objection, as applied to steam vessels, I propose to relieve the valve of a portion of its load by another arrangement, which I suggested two or three years ago, in the Register of Arts. This mode is represented in the annexed diagram, in which, in lieu of a *horizontal* lever, I have an *inclined* one, *l*, fixing the weight, *m*, on the upright portion of it; so that when the valve is lifted any given height, by the pressure of the steam, the weight is in effect brought nearer to the fulcrum of the lever; as the forces act perpendicularly, in the manner represented by the dotted lines in the figure, and a lever having the power of 4, is reduced to a power of 3 by a very slight motion of the cover of the valve; the several parts of which differ only from the first, in being an inversion of their order; *n*, in this case, being the steel plate, and *o* a piece of tube, whose edge is accurately turned, so as to touch the plate throughout the line of its periphery. Practical men will decide which plan merits the preference, either as respects the utility, or the facility of construction. There should, of course, be a stop, to limit the range of the lever.

On the same page of the Register wherein I suggested the last mentioned plan, I proposed, as an *additional* security to boilers, that when the mercury should be forced out of the gauge by the undue pressure of the steam, it should be received into a vessel suspended to the power end of a long lever of the first class, whose other end, (near to the fulcrum,) should be made to lift a safety valve from its seat, loaded with a weight greater than that which ejected the mercury from the tube. By this arrangement the valve would be kept open until matters were arranged, and security to persons and machinery be instantly afforded. If the principle of this proposition be approved of by your committee, I need not point out to them the means of carrying it into execution.

As the various suggestions published in the scientific journals of Europe and America, will, of course, undergo the investigation of your committee, it would be supererogatory in me to notice them particularly; but I will just mention that the fusible plug, and Sockl's valve, seem to me to deserve their consideration; and were I not fearful of rendering my letter too tedious to be read, I could mention various other plans to effect the same object that have occurred to my mind; I will, therefore, here conclude my already too long letter, with expressing the hope that *something, however little,* may be gleaned from it, and my anxious desire that the committee may rather be induced to inquire whether effective boilers cannot be made, which would injure no person or thing, if an explosion should take place, than into modes of preventing the bursting of boilers that scatter death and destruction around them when an explosion occurs.

I am, with great respect,
Your obedient servant,
L. Hebert.

(No. XII.)

Letter from Thos. W. Bakewell, Esq., of Cincinnati, Ohio, in reply to the Circular of the Committee of the Franklin Institute.

Cincinnati, November 1, 1830.

I now enclose a copy of my report to the Secretary of the Treasury, on explosions of steam boilers, which I think contains all the essential information of which I am possessed.

Please receive this as my answer to your communication on that subject, which would have been attended to sooner, but for private engagements, and a latent conviction that the Franklin Institute did not stand in need of my services.

I am,
Very respectfully, yours,
Thos. W. Bakewell.

FOR THE FRANKLIN INSTITUTE.

Copy of a Report to the Secretary of the Treasury.

Sir,—A copy of your letter to Morgan Neville, Esq., of this place, together with a list of interrogatories, relating to the explosions of steam boilers, have been placed in my hands by that gentleman, with a request that I should give such information in reply to them as I may possess.

The interrogatories appear to be addressed more particularly to those who may have been present at an explosion of a steam boiler, and to relate to the circumstances growing out of a disaster of that kind. As I have never been present at an explosion, I shall proceed to the subject apart from the order in which the interrogatories are made. It is desirable that a statement of this nature should be composed of as much of fact, and as little of theory, as possible; and the subject has consequently engrossed my attention for several months, in obtaining such information as might enable me to present a full narration of facts attending many of the explosions on the western waters; but in this I have been disappointed, owing to the confused and contradictory statements of the parties present. I am, therefore, compelled to rely, in a great measure, on the impression made on my mind, by the several accidents, at the times, respectively, when they occurred, with the consequent risk of my report being biassed by my own peculiar views.

I have been, theoretically and practically, acquainted with the steam engine, both in the making and using of that agent, for nearly twenty years. My experience in its use has consisted chiefly in its application to boats, and I believe no alteration or improvement, either real or pretended, during that period, has escaped my notice.

I have every reason to believe, that most of the explosions of boilers arise from the simple fact of the steam being urged to a density beyond the strength of the boiler, unconnected with the production of hydrogen gas, or any sudden chemical change in the constituent parts of water. But that explosions have occurred, when the steam has not been above the usual working pressure, and under circumstances which cannot be explained, but by admitting the rapid production of some kind of gas, or steam, in quantities too great to be carried off by the safety valve. The *immediate* cause of this last species of explosions, cannot, with certainty, be known. It is, however, generally agreed, that it never takes place unless from a want of a sufficient supply of water, certain parts of the boiler or flues become red hot. The steam, also, in this case, will sometimes be so much heated as to set fire to the deck, or any combustible substance in contact with the boilers; and the steam admitted to the engine in this state, will burn the hempen packing and wood contiguous to the engine. To the above effects I have been an eye witness, but no explosion ensued. And here I would observe, that although there exists a difference of opinion, as to the proximate cause of explosion in a boiler thus circumstanced, it is generally agreed, that to inject water, before the fire shall have been extinguished a sufficient length of time for the boiler to cool, is the most dangerous step that can be taken.

The two opinions as to the cause of explosions, by injecting additional water, or by agitating that already in the boiler, in this heated state, are first, the oxidation of the hot iron, and the consequent disengagement of hydrogen gas, which, by its subsequent combustion, creates the explosion of the boiler. The other opinion is, that the rapid production of steam, is of itself sufficient to account for the effect, and that if hydrogen gas be generated, it acts, by its expansive force, as a gas, in addition to the steam; and in corroboration of this view of the case, it is alleged, that copper boilers have exploded under circumstances which might well have been attributed to the combustion of hydrogen gas, had not the material of which they were made precluded the idea.

The only case on the western waters which we are compelled to refer to one, or other, of the last two mentioned causes, is that of the steam-boat Grampus, whose boilers, six in number, cylindrical, 38 inches diameter, with two 14 inch flues in each, exploded simultaneously, about daylight in the morning; and after it had been discovered that they contained very little water, and a plentiful supply was suddenly thrown in. It is said, but not well established, that a smoke, and smell of burning, was perceived before the explosion.

Several explosions have taken place by suffering earthy sediment to accumulate on the bottom of the boiler. This sediment will, in time, become heated, or baked, to dryness, and the contiguous metal attain a red heat; when thus weakened the metal is incapable of sustaining the ordinary pressure of steam. The late accident on board the steam-boat Caledonia, was from this cause. But the most frequent cause of explosion has been from the direct pressure of the steam, without recurring to others, more remote or occult.

Owing to explosions having taken place after the engine has made a few strokes, the idea has obtained, that the steam was not at the highest point at the instant of explosion. Moreover, it is contended that explosions have taken place at starting, when the steam was certainly not higher than it had frequently been.

It will be observed, however, that when a boat is *about to start*, it is usual to prevent the further escape of steam through the safety valve, and to urge the fires; and that owing to the gradual and slow motion of the engine for some time, (say half a minute,) after starting, the steam is generating faster in the boiler than is demanded by the engine, and that the point of time, when the steam is at the highest pitch, is more frequently over half a minute, than under that period of time.

It is known, also, that a boiler, or iron shaft, or other piece of machinery, will give way by a continued strain, which strain shall be less in degree than would be sustained for a short time without injury; and that it by no means follows, when a boiler explodes by excess of steam, that it never had previously been subjected to an equal pressure.

I am not aware of any instance where two successive and distinct explosive efforts have been detected, as alluded to in your last query. This, however, was stated to have been the fact in the explosion at Bowen's mill, at Pittsburg, in 1821. I had satisfied myself by personal investigation at Pittsburg, that this report was erroneous, and in a description of that disaster, lately received from Mr. Bowen, the idea is again refuted. The boiler gave way at the bottom, over the fire, and was known to contain sufficient earthy matter, to warrant the conclusion that the baked sediment was the immediate cause of the explosion. The usual source for the supply of water, had been interrupted, and the boiler supplied, for three days previous, with water from a muddy well.

An explosion took place, about eighteen months ago, in M'Mickle's mill at Pittsburg, under circumstances so similar to that at Bowen's, that it is fair to attribute them both to similar causes. It was known in both the above cases that there was no deficiency of water. By the aid of a few figures, (not necessary to introduce here,) it would be easy to show that the steam alone was much more than adequate to the effect, or the projecting of the boilers from the mills.

As an instance of the difficulty of arriving at the truth, in occurrences of this kind, allow me to state, that in the year 1827, the steam-boat Union, Capt. Clark, when a few miles below this place, burst off one of the cast iron ends of her cylindrical boilers, 36 inches diameter. The after end, which flew off, passed, together with water and steam, through the cabin, tearing down all the light partitions which intervened, and laying open the cabin by parting its sides from the deck above. The boiler, by the unbalanced pressure, or reaction, after the end flew off, was projected over the bows of the boat into the river.

The boat was shoving off from the shore at the time, and about to start, but as far as I can learn, the wheels had not made a revolution.

I saw the captain and some of the crew soon after the accident, who assured me there was plenty of water, for he, (the captain,) saw the gauge cocks tried two minutes before the explosion. But at a subsequent period, and after the captain had conversed with some of those who contend that a boiler cannot burst with "fair play," as it is termed, he became of the opinion, that the cause was a deficiency of water, and the flue being red hot; and did not doubt of its being collapsed, and that the formation and combustion of inflammable gas, or some other hidden and uncontrollable circumstance, produced the explosion.

The history of the case rested on these grounds until the boiler was recovered from the river, when it was seen that the flue and interior of the boiler were perfect, and exhibited no signs of having been heated red hot. A thin whitish coating of earthy (probably calcareous,) matter was on the upper part of the flue, which some, at first sight, supposed to indicate its having been heated; but this appearance is observable on all flues after the water is drawn off from the boilers, at the same low stage of the river. The flue in this boiler did not pass through the end which was forced off, but turned down by an elbow, short of the end, to receive the heated air and smoke from the furnace below.

The steam was usually worked at about 80 lbs. to the inch, and at the time of the accident the Union was in contest with another boat.

The principal reason of explosions having been more frequent of late, on the western waters, than formerly, is simply because the engineers work the steam higher; and this they are enabled to do with the same boilers by cutting off the steam shorter, not only with cams suited to that end, but by "pinching" the steam at the throttle valve.

This mode of proceeding, together with the prevailing notion, as before stated, that boilers do not, or will not, burst by "fair play," that is, by the pressure of the steam alone, with plenty of water, has been the main source of the recent disasters.

The success which has attended the British act of parliament, predicated on the most direct and obvious view of the case, to wit: that boilers burst because the steam is too strong, or the boiler too weak, is deserving of our serious consideration. That act provides that every boiler shall be tried by hydrostatic pressure to bear three times the strain, which shall be indicated by an extra certified safety valve.

The details of the examination inducing this act may be found in "Partington, on the Steam Engine," London Ed. of 1822. I conceive that this very severe test secures the boilers from explosion, not only from the pressure of the steam *with* a sufficient supply of water, but in all ordinary cases *without* a proper supply; for with this required extra strength, the flues of most boilers would sustain the working pressure at a red heat, and the boilers of the English boats are exempt from one of the sources of accidents with us, viz. the gradual wasting and weakening of that part of the bottom of the boiler, which in many of our boats is exposed to the action of the fire, and kept in a red hot state by baked and dry earthy sediment over it.

The bottoms of their boilers, where the sediment settles in injurious quantities, are not exposed to the action of the fire any more than those of most of our eastern boats; and a very slight test of strength, beyond that allowed by the safety valve of the "Chief Justice Marshal," would have shown that the lower part of her boilers, or large flues, was insufficient to stand the fair pressure of the steam, though not exposed to the fire.

If a test, equally severe with that of the British act, were required in this country, nearly all our boats, both eastern and western, would be rendered useless; and it therefore remains to be considered, to what degree it may be imposed, without being oppressive, in the present condition of our steam navigation.

Permit me to suggest, that all boilers of boats, used for the conveyance of passengers, be proven at least once in twelve months by hydrostatic pressure, to be capable of sustaining *double* the pressure that should be indicated by an extra safety valve; which said extra safety valve should be under the sole control of the master of the vessel, and he be under bond and oath that no greater pressure of steam should ever be carried than shown by the lifting of said extra safety valve. That surveyors be appointed at convenient ports to see to the proper and faithful carrying into effect of this measure, who should grant their certificates accordingly.

Every boat has, or may have, at a small expense, the means within herself of applying this required test, by attaching a temporary lever to her forcing pump, to be worked by hand, or a small one provided for the purpose.

This test might be relied on for preventing explosions from the usual cause, (excess of steam,) and also, in most cases, where the accident takes place from the metal being weakened by heating.

I know of no legislative enactment that can provide against a deficiency of water, or an accumulation of mud, or saline deposit, in the boiler.

The contrivance called a "tell-tale," designed to give notice when the water gets too low, and sometimes made self-acting, so as to supply the boiler, is with reason objected to by practical men as uncertain in its own operation, and tending to lull the engineer into carelessness and false security, and whenever the boat should have motion from a sea, would be utterly useless. It is true that the constant turning of the gauge cocks is an irksome office, and it is apt, on this account, to be neglected. If some more easy and agreeable mode could be adopted, of making the engine tender an *eye witness* to the height of the water in the boiler, it would go far towards removing danger from this source. Tubes of glass have been tried in Pittsburg and in this place, the lower ends of which communicated with the water, and the upper ends with the steam, which answered the purpose completely so long as the tubes remained entire; but the manufacturers have not been able to anneal any tubes sufficiently to stand long in that situation.

I am informed that glass in the form of tubes when of the required thickness to sustain the mechanical pressure to which they are exposed, will not stand the inequalities of temperature at the inner and outer surfaces, but that there is no difficulty in making a *plate* of glass stand; and I have, in consequence, ordered some plates for this purpose, which I intend to insert in the sides of a square cast iron pipe, attached to the end or side of the boiler.

Of High and Low Pressure Engines.

The comparative merits of these two kinds of engines, both as regards safety and efficiency, have become somewhat of a party question, and great caution is required in receiving the opinions of any on this point. It may, therefore, be expected that I should be prejudiced in favour of the one or the other, and there is no reason to hope for impartiality in the present notice of them, except so far as the opinions of others, (with respect to myself,) and the using of both kinds of engines, may give grounds for supposed impartiality. Both these circumstances exist in favour of an unprejudiced report of them.

The proportional extra strength of *all* boilers, over that of the steam intended to be carried, may generally be assumed as equal, and the liability to explode as equal, but the disastrous consequences in the event of an explosion may be estimated to be in proportion to the height or strength of the steam at the time of explosion. Hence it must be inferred that the balance of safety is on the side of the low pressure engine, and I believe the experience of the last ten years will bear out this conclusion; not so much by the greater number of accidents with high pressure engines, as by the greater destruction when they do happen.

To engineers "high and low pressure" are indefinite terms. Engines which condense the steam, (as distinguished from those which suffer it to escape in the air,) work steam at all the various pressures from 5 lbs. to 100 lbs., on the square inch, and as good a vacuum may be obtained in the one case as in the other, contrary to popular opinion, and that expressed in several works on the subject. The same quantity of caloric, (and of steam by weight,) will pass to, and be overcome by, the condensing apparatus, with the same furnace and boilers, whether the steam operate through a large cylinder at five pounds, or through a small one at 100 lbs. to the inch; but the *nett* gain by the vacuum, on every square inch of the piston, (say 10 lbs.) is the same in both, so that the smaller the cylinder, and the higher the steam worked, the less does the vacuum become an object, and is consequently, in most cases, relinquished altogether; and then the engine is called "high pressure."

Very respectfully, &c.
(Signed,) Thos. W. Bakewell.
Cincinnati, 1*st November*, 1830.

(No. XIII.*)

Cincinnati, *January* 19, 1831.

Dear Sir,—Your favour of 3d inst. is to hand. The only additional experiment to those enumerated, which I think desirable, is in connexion with No. 7. This experiment, (No. 7,) is to "ascertain whether any other gases than steam are produced in the boiler;" but it is of the greatest importance to know whether any other gases thus supposed to be produced will explode, or ignite, in the boiler producing them.

If a boiler be filled with water, (or nearly so,) and the steam suffered to escape at the top, as is the case with an engine boiler, it may be presumed that all the atmospheric air is expelled from the boiler, and the water, before it should become so low as to expose the hot metallic surface to the steam. If the water, (or steam,) be decomposed by the heated metal, and the combustion of the hydrogen gas can, at any subsequent period, take place, while in the boiler, what prevents the combustion in small portions as soon as it is formed, and while in contact with the heated metal, (thus preventing an accumulation of it;) or what degree of accumulation should determine an explosion? The opinion I hazard on this point is, that if hydrogen gas be produced in a boiler, *circumstanced as above*, it would only be similar to a gas generator, and that the gas would not ignite until it had access to the atmosphere, and that the gas issuing from an orifice might ignite, but would not produce the combustion of that within. I know it has been stated, (hypothetically,) that a part only of the oxygen is taken by the metal, and a part left in a state of mixture with the hydrogen, which, *in due time*, causes the explosion.

I am, very respectfully,
Yours,
Thos. W. Bakewell.

[to be continued.]

---

* In reply to a letter stating the course of experiments which the Committee of the Institute were about to undertake.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Observations on the importance of Meteorological Observations, particularly as regards the Dew Point: and also on the several fluctuations of the Barometer, by JAMES P. ESPY, *Professor of Languages.*

IN a previous essay I endeavoured to awaken the attention of scientific men to the department of meteorology. I ask again why is it that this highly interesting and useful branch of human knowledge makes such slow advances, whilst almost every other department of physical science is receiving important additions every year?

The labours of chemists have made us acquainted with the elements of the atmosphere which surrounds us, and the illustrious philosopher of Manchester, has enabled us at any moment, with the simple aid of a common thermometer, and a tumbler of cold water, to tell with absolute certainty, not only the number of grains* of aqueous vapour contained in a cubic foot of air, but the whole weight of the aqueous atmosphere to its very surface; and yet with this powerful instrument in our hands, meteorology languishes; we cannot yet predict the weather forty-eight hours in advance—the very cause of rain is unknown—and the "*Dew Point*" is published in only one journal in the United States.

Let learned and scientific societies answer to themselves and to the interests of mankind for this egregious neglect. Do philosophers think that no more discoveries can be made on this subject? and that the weather never can be predicted?

If indeed we were obliged to depend upon those imperfect hygrometers in use before Dalton's discovery, there would be some reason to despair of ever being able to predict the weather; but when we consider that the quantity of vapour in the atmosphere is the only constituent which changes its proportion, varying from $\frac{18}{1000}$ of the whole atmosphere when the dew point is 13 Fah. to $\frac{88}{1000}$ when the dew point is 76, (indeed the dew point sometimes sinks lower than 13 Fah. but I have never seen it higher in Philadelphia than 76,) and when we consider that the weather depends so much upon the quantity of vapour in the atmosphere, it becomes highly probable, that cotemporaneous observations, made on the quantity of vapour alone, in different parts of our widely extended country, would solve the problem of the weather, which has hitherto eluded the researches of the most patient observers.

My object in this communication is to endeavour to awaken in your readers an interest in this subject by communicating a few facts of my own observation, and correcting some prevailing errors which vitiate all systems founded upon them.

It is, I believe, universally admitted, that whenever the air over a particular region begins to be expanded by heat more rapidly than the air of surrounding regions, a flow of air immediately takes place towards the hotter part.† Now this is not the fact—for the air, in becoming hotter, increases in elasticity, and presses harder in all directions than it did before, upwards, and downwards, and laterally; and moves the surrounding air outwards as well as upwards until the equilibrium is restored. This increased elasticity, or pressure of the air, is indicated by the barometer after sunrise in all climates, particularly in the torrid zone, where its semidiurnal fluctuations are so regular that its point of elevation almost indicates the hour of the day. It rises regularly from sunrise till 10 o'clock, about which time the heat is increasing most rapidly; it then falls till five, about which time the rapidity of refrigeration is the greatest, and, of course, the pressure least; after which it rises by reciprocation till about ten, and then falls till sunrise, for the same reason. These fluctuations may be detected in this latitude by taking the mean of a great many observations, recorded at 9 or 10 A. M., and 5 P. M. In the city of Philadelphia, 45 feet above the sea, very careful observations have been made on the barometer since the 1st of April of the present year.

---

* See table at the end of this essay.

† See review of Mr. Daniell, American Quarterly, for March, 1828.

The barometric mean for April, between 9 and 10 o'clock, A. M. was 30.026 inches, and at 5 P. M. 29.968. For May, at the same hours, 30.04 inches, and 30.00 inches. For June, at the same hours, it was 30.145 and 30.111, and for July 30.10 and 30.06. For each of these months, then, the barometer, at a mean, has been about four one-hundredths of an inch higher between 9 and 10 o'clock in the morning, than at 5 in the afternoon. No doubt the fluctuations by reciprocation could be detected by observing the hours in which they take place. This I intend to do, before you receive my next communication.

The general principle which I wish to state as the cause of the semidiurnal fluctuations of the barometer, is that a sudden increase of temperature in the air will cause an increased pressure on the barometer, and vice versa, a sudden diminution of temperature will cause a fall of the barometer; but it must be understood that these effects on the barometer will be observed at the moment of the change of temperature, before the quantity of air over the observer has time to be increased or diminished by flowing *on* in the upper regions in the case of refrigeration below, or flowing *off*, in case of expansion, by increased heat.

To illustrate my idea by an example: Suppose at sunrise the temperature of the air over the whole island of Great Britain to be 32° Fah., and suppose the temperature to increase to 42 by 10 o'clock, of all the air covering the island, to the height of 96 feet. Now, as the experiments of many philosophers prove that the bulk of air, at the temperature of 32, is increased $\frac{1}{480}$ for every degree of Fah., therefore, by an increase of 10 degrees, this lower stratum of air, 96 feet high, will be increased in bulk $\frac{1}{48}$ of the whole; and if the air around Great Britain, to a great extent, expands as fast as the air over the island, then will the pressure of air inwards, from the ocean to the island, be equal to the pressure outwards, and the whole atmosphere over the island will be thrust upwards 2 feet by the expansion of the lower stratum of air 96 feet thick.

But if the lower stratum of air over the ocean does not increase in temperature, after sunrise, as fast as that over land, then will the effect of some part of the greater expansion over land be, to thrust the air out laterally from the land to the ocean; but in either case, the barometer will rise while this process is going on. This rise, moreover, will be in proportion to the rapidity of the increase of temperature; for if this lower stratum of air could be supposed to increase in temperature instantly 10 degrees, then would there be a rise of the barometer for a moment nearly $\frac{1}{48}$ of 30 inches; for the inertia of the air itself, would, for the first moment after the increase of temperature, afford nearly the same resistance to the motion of expansion, as if it were confined by an inexpansible vessel.

A remarkable proof of the great resistance inertia makes to sudden motion, was given some years ago in Silliman's Journal. A quantity of fulminating powder lying on a table and covered with a bell glass, accidentally exploded—the bell glass was merely lifted up a short distance, and broke in falling, but a hole was made through the table. The inertia of the powder, together with the atmospheric air, was so great as to react on the table with such force as to pierce a hole through it.

If I have been so fortunate as to render myself intelligible in showing the cause of the rise in the barometer by an increase of heat, I flatter myself that any one may easily perceive the cause of depression in the afternoon, and the two remaining fluctuations by reciprocation during the night, without any further illustration from me. I will, however, before I pass to another subject, answer one objection which may be proposed to the explanation here given. It may be asked if increase of heat in the air is the cause of a rise of the barometer, why does not the barometer continue to rise till the hottest part of the day? I answer, this would be the case if the air were confined in an inextensible vessel. This, however, is not the case, but the whole column of atmosphere above the expanded part, is raised, and the greatest resistance it makes to raising is at the moment when it is thrust upwards with the greatest velocity; that is, not when the heat is greatest, but when it is most rapidly increasing, which is known to be about 9 or 10 o'clock; about half way between the time when it begins to increase, at sunrise, and ceases to increase, at the hottest part of the day.

If I have been successful in establishing my own theory of the semi-diurnal oscillations of the barometer, I need not stop to refute Professor Leslie's theory of the sea breezes being the cause, though it is known that these oscillations take place in the midst of the great Pacific ocean. Nor Mr. Daniell's theory, which makes these oscillations depend upon the polar currents, and whose theory makes it necessary that on the same longitude, even at the autumnal and vernal equinox, the barometer should fall in high latitudes at the same moment it rises in low. Nor M. Ramond's theory, though quoted with approbation by M. P. E. Morin, which makes these oscillations depend on the increased and diminished quantity of air over our heads; that is, that more than a mean quantity is over our heads at 9, A. M. and less than a mean quantity at 5, P. M., which is caused by the surface of the atmosphere being elevated above its mean height at noon, and depressed below its mean height at midnight, and of course at noon it runs off, and at midnight it runs on, from the east and the west of those longitudes.

It appears at first sight that some effect should be anticipated from this principle. It is worth a moment's reflection: let us subject it to actual calculation.

It is known that at the height of a few hundred feet, the air changes very little in temperature during 24 hours when it is clear, for the rays of the sun pass through clear air without heating it much, and it is chiefly by contact with the surface of the earth that the lower stratum of air becomes heated during the day, and cooled during the night. Even in this lower stratum, the difference of temperature between day and night does not often exceed sixteen degrees. Let us, however, put an extreme case, and suppose that the difference of temperature of the lower stratum of air 500 feet high is 20 degrees; the expansion due to this elevation of temperature in the day above the night, is about 40 feet. If, now, we suppose the whole of the atmosphere above this to vary in temperature daily one degree, the elevation of the atmospheric column due to this increase of temperature in the day, will be $\frac{1}{480}$ of the whole, if we suppose the mean temperature of the air to be 32. Now $\frac{1}{480}$ of 40 miles, the height of the atmosphere, is 440 feet; add to this 40 feet, the expansion of the lower stratum of air, as above, and the whole elevation of the atmosphere, at the hottest part of the day, above the coolest, is 480 feet. Now let us see with what velocity the upper stratum of air will move from the greatest elevation at noon, towards the greatest depression at sunrise. We have then an inclined plane 480 feet high, one quarter of the circumference of the atmosphere in length; that is, about 33,000,000 feet, or 68,800 times its height. Now, by mechanics, a body free from friction would run down such an inclined plane $\frac{1}{68800}$ part of $16\frac{1}{12}$ feet in one second of time, and as the spaces passed over down inclined planes are as the squares of the times, in six hours, even if the height of this inclined plane did not diminish, which it does, the space descended along the plane would only be 109175 feet, which is about $\frac{1}{302}$ of the whole elevation; that is about 19 inches of atmospheric air at a mean density; a quantity too small to be appreciated in the barometric fluctuations. Many other objections might be brought forward against this theory of M. Ramond, but I forbear to state them now.

The next prevailing error I shall notice is, that "mountains attract clouds." See Edinburgh Encyclopedia, article Hygrometry; and Library of Useful Knowledge, article Physical Geography. Now that clouds frequently appear near the tops, and on the sides of mountains, when they appear no where else, is a well known fact. Let us see how this can be accounted for on established principles, without supposing any mysterious attraction for which no reason has ever been assigned.

Mr. Ivory says, "if a mass of air were suddenly reduced to half its bulk, the heat evolved would be 90°"—consequently if it were suddenly expanded to twice the space, it would lose 90° of temperature. (Phil. Mag. Feb. 1827.) Suppose, now, to put an extreme case, a current of air at the temperature of ninety, completely saturated with moisture—that is, having its dew point at 90°, should meet a mountain, and blow up its side; by ascending, it would expand, and by expanding it would become colder one degree for every $\frac{1}{90}$th of expansion; let us see how much vapour would be condensed from a given quantity of air when it has ascended so high as to occupy double the space, and when the temperature is zero. By the table given at the end of this article, a cubic inch of air, saturated with vapour, at the temperature of 90°, contains .00836386 grains of aqueous vapour, and at the temperature of zero, 2 cubic inches, saturated, contain .00089914 grains. Now the former quantity is more than nine times the latter; therefore more than $\frac{8}{9}$ of the aqueous vapour which the air contained at the foot of the hill, will be deposited in rain before it rises so high as to occupy double the space. This calculation is on the supposition that the ascent is so rapid that it takes a temperature due to sudden expansion. If it ascends very gradually it will be shown presently that its temperature will not sink so low by about 18 degrees, for the mean temperature of the air at that height is about 72 degrees, and not 90° lower than that at the surface of the earth. But even at this temperature the quantity of moisture could not be quite one-fifth in the upper station of what it is in the lower. Thus have I demonstrated that nothing is necessary to produce clouds and rain on the sides of mountains, but an ascending current, whose dew point, at the base, is near the temperature of the air. That such a current upward actually takes place, every one who has been on the side of a mountain many times can testify, for he has felt the air blow upwards.

The principle here developed may also serve to account for the fact that the quantity of rain on the sides of mountains is greater than on the plain below. For notwithstanding M. Leslie has given currency to an opinion that more rain falls in low situations than high, the reverse is a well established fact. Indeed the whole economy of nature requires it, and we might be pretty certain of the fact à priori.

"In the neighbourhood of Kinfaun's castle," (says the Edinburgh Encyclopædia, article Meteorology,) "a rain guage is placed on the summit of a hill, 600 feet above the level of the sea, and another in a garden at the base of the hill, about 20 feet above the sea. The following is the mean result of the two for five years: from 1814 till 1818, hill guage $38\frac{84}{100}$ inches, garden guage $25\frac{66}{100}$ inches.

"No part of the above difference can be ascribed to any thing in the situation of the garden guage, but its being lower down. It is fully exposed to the rain, and as the best proof of this, its average amount for six years is about two inches greater than that of another, situated in an open country, at the distance of about a mile."

Indeed there is strong reason to believe that even at a distance from mountains there is more rain falls at some distance above the surface than at the surface itself. This is certainly the case sometimes, for I have known a large shower to take place when the lower stratum of air was more than 20 degrees above the dew point, and consequently the drops of rain falling through this heated air would certainly evaporate some; and as an absolute proof of this, I have known the dew point to rise two degrees during a shower of half an hour.

It is true, the reverse of this sometimes takes place, for the drops of rain coming from a great height enter the region below with a temperature greatly below the dew point, and of course increase in size; whether this latter effect is equal to the former cannot be determined from theory in its present imperfect state.

However this may be, it is certain it frequently rains above when it does not rain below. In the middle of every dense cloud there is a considerable rain. The upper part of the cloud is in air cold enough to condense the vapour, and the lower is in air warm enough to evaporate it, and the middle frequently consists of pretty large drops of rain, which fall with velocity enough to give an *impulse* to the air, which is felt at the surface of the earth, for the cloud, (that is, the rain,) is the cause of the accompanying wind, and not the wind of the rain.

In meteorology it is not always easy to distinguish of two concomitant phenomena, which is the cause and which the effect. For example, it has, universally, so far as I know, been believed that the very great flood of rain which frequently succeeds immediately, or accompanies, a very sharp clap of thunder, is caused in some way by electricity. In Walsh's Notices of Brazil, vol. ii. p. 92, a thunder storm is explained on this supposition.

"It becomes quite dark in mid-day, except when some lurid blaze enveloped us, which was accompanied by a sheet of water, which fell on us like a cataract, and almost beat us to the ground. The explosion of sound immediately followed the flash.—If I could have divested myself of the alarm which the immediate proximity of such awful danger excited, I should have been delighted to contemplate the chemistry of nature on her grand scale. I remember with what pleasure I had seen Sir H. Davy produce water from the combustion of hydrogen and oxygen. Here it was generated in an instant from the same cause, and I was standing in the midst of the combustion, and admitted, as it were, into the very interior of nature's great laboratory."

Again, in the article Meteorology, mentioned above, "That electricity is a frequent and powerful agent in the formation of rain is extremely probable. The well known fact that the rain which accompanies a thunder storm is more copious than in any other circumstances, is evidence sufficient that it is frequently modified or increased by the influence of electricity."

I once thought with the writer of this last quotation; but when I consider that the immense flood of rain which frequently accompanies thunder succeeds it so immediately that the drops could not have time to fall many feet, much less from the clouds; and that Mr. Walsh's idea cannot be correct, for there are no hydrogen and oxygen uncombined in the atmosphere to produce combustion; and if there were, the result would be aqueous vapour, not water; I was compelled to look for some other explanation of this phenomena. The true solution of the difficulty, I think, will be found in considering the rain as the cause, and the lightning as the effect.

When a large quantity of rain is discharged from the clouds at once, and when the lower drops approximate very near to the earth, whilst the upper drops reach the clouds, they form an immense *discharger* for nature's great battery, and the lightning is discharged just as the lower drops of this sudden deluge are about to fall to the earth; but as the great mass of rain generally succeeds the electrical discharge, it is not wonderful that the cause should have been considered the effect, and the effect the cause.

The utility of lightning in the economy of nature, is yet to be discovered. That it, and the means of predicting the state of the weather will be discovered, at no very distant day, I have little doubt. In the mean time, nature must be patiently interrogated, and faithful answers will certainly be returned.

I come now to speak of an error of great magnitude, and of universal prevalence, I believe, in this country. It was first conceived by Professor Dwight, and it has lately been assumed by Professor Mitchell as the very foundation of a laborious theory, in which he endeavours to explain many meteorological phenomena, particularly why the mean annual temperature of our continent east of the Rocky mountains, is lower than that of Europe on the same latitude. The error I allude to is, that the air in large quantities sometimes descends from the upper regions to the lower, and brings with it a great and sudden depression of the thermometer; and that universally when the wind blows across mountains, in descending down the side to the leeward, it brings down cold weather with it. It seems to be taken for granted by these theorists, that because the air is at a lower temperature in the higher regions than in the lower, if this upper air were brought down by any means, it would therefore be cold; forgetting another principle with which they are familiar, that air suddenly condensed by pressure becomes hotter. Now whether a portion of air suddenly brought down from the upper regions and subjected to a greater atmospheric pressure below, would be hotter or colder than the air at the surface of the earth, can only be ascertained by observation and experiment.

In the July number of the Philosophical Magazine, 1825, Mr. Ivory says, that Mr. Ramond had collected forty-two different measurements for the purpose of ascertaining the decrease of temperature in ascending the atmosphere. The greatest altitude in these is Gay Lussac's ascent, nearly 7600 yards; and in this particular case the height for one degree Fah. is 105 yards. The average of the whole, however, is 100 yards to a degree.

In the ascent of Gay Lussac, the thermometer fell from 55.4° to 17.1° below zero, that is 72.5° Fah.; at the same time the elasticity or weight of the air was reduced from 1 to 0.432, and the density to one-half very exactly. Now it is known by experiment, as was mentioned above, that air suddenly reduced by pressure to one-half the space acquires 90° of temperature; that is, if Gay Lussac could have transported some of the air from the height to which he ascended where the density was only one-half to the surface of the earth, where its density would be doubled, its temperature, if it neither lost nor acquired caloric, would be increased 90°, and so be 17.5° warmer than the air at the surface of the earth. In like manner it may be shown that if air be brought down from any other elevation, its increasing density will constantly keep its temperature above that of the air into which it is successively introduced, and the greater the elevation from which it is brought, the higher will be the temperature above the stationary air below.

Indeed it is easy to show that if the reverse of this is the fact, the equilibrium of the atmosphere could not be preserved; for if a current once commenced downwards, it would always continue to flow; for the descending column of air being, by supposition, colder than the surrounding air, would always be heavier, and it would consequently rush downwards from above, and outwards at the base, with a fury proportional to the supposed difference of temperature. Now as no such vortex exists in the atmosphere, we might, with great certainty, infer, á priori, that the air in the upper regions is not colder than at the surface of the earth it would become by being suddenly expanded to the same degree of rarefaction. It is known that a pound of steam, if the space it occupies is saturated, contains the same quantity of caloric at all temperatures. From this, Mr. Dalton inferred that every pound of atmospheric air contained the same quantity of caloric at all elevations; in this, however, the philosopher of Manchester was wrong, as was afterwards demonstrated by Mr. Ivory. Indeed it follows from the example given above, that air, rarified suddenly at the earth's surface, is only one degree in four colder than air of the same elasticity in the atmosphere, for 90 is nearly one-fourth greater than 72.5. Nor is it at all wonderful that the air in the upper parts of the atmosphere should contain more caloric to the pound, than it does below, for there the vapour is condensed into water to form clouds and drops of rain, and every portion of vapour which is condensed into water, gives out nearly 1000 degrees of caloric. (See Ure's Chem. Dictionary, article Caloric.) Perhaps it may appear inconsistent to some that the vapour should condense among strata of air which contains more caloric than an equal weight of air near the surface of the earth. But if they will recollect, that the vaporic atmosphere is more elastic than atmospheric air, and that, consequently, its density in ascending does not diminish as rapidly as that of atmospheric air, they will see how it should condense above rather than below. For more particular information on this point see Daniell's Meteorological Essays, a work invaluable to the student of this most interesting science.

In fine, on this point, I think it very clear that the air coming across the Rocky mountains cannot, on any theory, cause a diminution of temperature on the eastern side, for if the air becomes very cold by ascending on the western side, for the same reason it becomes very warm again by descending on the eastern. Indeed, on the principle demonstrated above, the air in ascending a mountain becomes colder at the top than air of equal elevation over a plane, and yet, in descending on the other side, it must manifestly recover its original temperature when it has descended to the same level.

Before I proceed to another subject, I will answer one more objection which might be urged against my position, that air brought from any height, however great, is not colder than the air into which it is introduced below, but warmer one degree in four. It is known that a summer's shower always cools the air, particularly if accompanied by wind, which is evidently caused by the downward motion of the air in the midst of the shower, for the wind blows outwards from the shower below in all directions, just as it should do on supposition of its descent in the middle of the shower. I answer, this is undoubtedly true, but the descending of the air is not the cause of the cold, but the cold is, in part, the cause of the descending of the air. I say in part, for it is partly caused by the impulse of the drops of rain in falling through the air. But it may be asked, how is the air cooled? The answer is easy. By the rain itself descending from a great height, in many cases much beyond the region of congelation, which in this climate is not much above two miles and a fifth. Being poured out in this cold region it descends into the warm air below, cools it down in some degree, and in cooling it dissipates into vapour: meantime another and another flood succeeds, until finally the air is cooled down almost to the dew point, when the rain which descends from above now reaches the earth, and the whole column of air under the cloud being now cooled many degrees lower than the surrounding air, descends, and in descending spreads out below, and produces a wind in all directions from the rain. It is not, however, to be supposed, that the wind at the surface of the earth will extend to any great distance from the shower; for the great condensation of the column of air under the cloud, and the still greater condensation of vapour in the cloud, will cause the air from the surrounding regions to flow towards the cloud; and this any person who attentively observes the phenomena which attend a summer's shower, may readily discover.

Do mountains then, it may be asked, produce no effect on climate? Yes, certainly; not so much by changing the temperature of the air crossing them, as by causing a diminished flow of air, especially near the surface of the earth, from one climate to another. The Rocky mountains for instance, by the winds which blow from the great Pacific ocean, cause the summers on the eastern side to be warmer, and the winters to be colder, than they would be, if there were no obstacle presented to these prevalent west winds; for it is too well known to need discussion here, that sea breezes render climates subjected to them, more temperate, both in summer and winter. This accounts in the most simple and satisfactory manner, for the mildness of the winters, and the coolness of the summers, on the western coast of Europe, in high latitudes, where the predominating winds are from the west, when compared to the severity of both winters and summers on the eastern coast of North America on the same latitudes. The ocean being warmer in winter, and cooler in summer, than the continents on the same latitudes, the wind which blows over the Atlantic, when it reaches the shores of Europe, must partake of this mild temperature.

A question here naturally presents itself. Is the cooling effect of the air from the ocean on the coast of Europe as great in the summer, as the warming effect in winter? Or, in other words, is the mean temperature of the year the same in Europe and America? Mr. Leslie answered this question in the affirmative. But it is now ascertained by actual observation that Quebec is as cold as Stockholm, though the latter is nearly 13 degrees of latitude further north; and that Cambridge, U. S., has the same mean annual temperature of London, though the latter is 9 degrees further north. If we examine why the sea changes its temperature for the different *seasons less* than the land, we shall discover that the difference between its temperature and that of the land is much greater in winter than in summer; and, consequently, the heating effect of the air which blows from it on the land in the winter, will be much greater than the cooling effect in summer.

The reason why the sea is colder than the land in summer is, because the rays of the sun penetrate and heat the water to the depth of many feet, whilst on land their influence is spent in warming the very surface. Some effect also may be produced by the mixing of the water by agitation, and also by evaporation, which may be supposed to be greater at sea than on land. But the whole amount in summer cannot be near so great as in winter, for in the autumn, as soon as the surface of the water begins to be cooled down in the slightest degree, it sinks, by its greater specific gravity, and the warmer water below takes its place, until the whole mass of water, to the very bottom, is cooled; and from this principle alone, the temperature of the sea at the surface will be preserved many degrees above that of land during winter. But this is not all; the specific gravity of the colder sea water at the north being greater than that of the water at the south, will, by hydrostatic pressure, cause a current of water at the bottom of the ocean, from the north towards the south, which must cause a current in the contrary direction at the surface, and all these effects, aided by the Gulf Stream, will keep the temperature of the sea, in high latitudes, many degrees higher than the land. Nor is this merely hypothesis. Baron Humbolt says he has found the temperature of the sea at great depths, even in the torrid zone, as low as 45 Fah. Now this can only be accounted for by supposing an under current from high to low latitudes. For this stratum of cold water lies between a temperature of 80° at the surface, and a temperature below increasing about one degree for every 50 feet of descent, as is abundantly proved by the regularly increasing temperature of mines in their descent. See Cordier on Temperature, &c.

Now if this cold water at the bottom of the ocean were not supplied with water from high latitudes, it certainly would acquire the same temperature as that at the surface.

In the month of December, Jonathan Williams, in passing from the United States to Great Britain, found the temperature of the Gulf Stream 70°, the open ocean 60°, and near the coast of England 48. If we suppose the mean temperature of the whole ocean between Quebec and England to be 56, it will be about 40 degrees warmer than the temperature of Quebec at that season of the year. Again, by a similar investigation, though I have not the exact data before me, I have no doubt it will be found, that the ocean is at most not more than 10 degrees colder during the summer, between those two places, than the mean temperature of Quebec for that time. Thus, upon the whole, it is manifest that the coast of Europe will be more heated by the air from the ocean during winter than it will be cooled during summer. If we had the exact temperature of the ocean in the north, and also in the south, and the mean depth, it would be easy to calculate, from the principles of hydrostatics, how much lower than a mean height the surface of the water in the north stands from its greater specific gravity than that of the south, and the velocity of the current below, towards the south, and of the current above, towards the north, could easily be deduced. In the mean time, I content myself by indicating the principle, and assigning a few reasons for believing that the depression of the surface of the sea in the frigid zone, below that of the torrid, is not less than 27½ feet. The mean temperature of the ocean, within the arctic circle, cannot be far from 32°, for it never rises much above it, and cannot fall much below it, without freezing; for the temperature of the freezing point is stated in the books at 29, though Capt. Parry found it as low as 25, at great depths, on the west side of Greenland, when the temperature of the surface was 32.* At the tropic of Cancer it is about 75°, that is, 43° warmer than the former.

Now water at 32° is about $\frac{1}{22}$ or $\frac{1}{23}$ denser than water at the boiling point 212°: wherefore if the contraction was equable, all the way down from the boiling point to the freezing point, the density of arctic water would be about $\frac{1}{92}$ greater than tropical water. But because the contraction is less at low temperatures than at high, let it be only one-third this quantity, that is $\frac{1}{278}$, then will the polar sea stand below the level of the equatorial $\frac{1}{278}$ of the whole depth.

---

* In the same latitudes, Capt. Scoresby found on the east side of Greenland, the temperature of the sea gradually increase at great depths, that of the surface being 32. If it should be discovered that the outlet to Baffin's bay is not so deep as Capt. Parry's observation extended, it will afford a satisfactory explanation of the low temperatures of the water at great depths in Baffin's bay. For as it is known that sea water does not follow the law of fresh water, which begins to expand when cooled below 40, but goes on contracting by cold, even down to 18 Fah., provided it does not congeal till it arrives at that temperature, which it will not do if it is kept perfectly still. Now the water, as it cools and condenses in the winter, sinks and carries its temperature with it, and as by hypothesis, the outlet to the bay is too shallow to allow it, by hydrostatic pressure, to flow towards the equator, it lies still at the bottom, and like the lake of Geneva, and some of the lakes of Scotland, whose waters at the bottom are about 41 or 42, it retains this temperature throughout the year. Quere—Does not Capt. Parry's observations prove, that the temperature of the freezing point of sea water is lowered by pressure?

If now we suppose, as Dr. Young has demonstrated from the velocity of the tidal wave, that the mean depth of the sea is 15840 feet, or three miles, we shall have the difference between the polar and equatorial level of the ocean, in case of equilibrium, 57 feet. But as a current above to the north, and one below to the south, must take place, the difference of level will be only half this quantity, or 27½ feet, as stated above.

It may be objected to this theory, that no such superficial current, with the exception of the Gulf Stream, from the south to the north, is known; on the contrary, it is known that large masses of ice are found in latitudes far south of the arctic circle, which had floated south on the surface of the sea; that it is reasonable to suppose that the surface of the sea at the equator should stand constantly *lower* than that of polar seas, on account of the superior evaporation there, which is about six feet a year more in the former than in the latter climate, and that the current is actually known to be from the Hebrides to Spain. I grant the correctness of all these facts, and it may be added, that the immense quantity of ice and snow which is melted in the polar regions, during the summer, and which runs down into the ocean, must raise it a little above its mean level, and, as is proved by fact, actually invert the course of the current, in the eastern part of the Atlantic.

Notwithstanding all this, we have no reason to believe there is as much water flowing south on the eastern side of the Atlantic, as there is north on the western side at the surface; and besides all the latter facts which tend to diminish the superficial current to the north, operate to increase the current below towards the south.

Thus have I shown clearly, from theory, that the mean temperature of the Atlantic, in high latitudes, must be greater than that of the land on the same latitudes; consequently, the country to the leeward must have its mean annual temperature increased.

I come now to discuss the subject of rain, the most important of all meteoric phenomena, but one which has never yet been satisfactorily explained. Before I bring forward my own theory, I will observe that the only theory which has ever been advanced, possessing any plausibility, is that of Dr. Hutton.

The Doctor had observed that it frequently rained after he observed two currents of air moving for some time in different directions; and he deserves great credit for anticipating a fact which has since been amply demonstrated by experiment, that if two masses of air, of different temperatures, saturated with moisture, were mingled together, the united mass, with its common temperature, could not contain all the moisture which they contained before the union in the form of vapour, and of course there would be a precipitation. Hence the Doctor inferred, that it was only necessary for large masses of air, containing as much aqueous vapour, or nearly as much, as they could hold, to be mingled together, and rain would be the consequence. This mingling he supposed actually took place when a current above and a current below blew for some time in different directions. Such was the plausibility of this theory that as soon as it was announced it was universally received by philosophers, and after the assumption of the mingling of airs of different temperatures producing deposition was demonstrated, the hypothesis was deemed to rest on the solid basis of fact. I admired the theory for its beauty, and never doubted for a moment the justness of it, until I discovered that the dew point frequently falls just before a rain.

This phenomenon was so contrary to my anticipations, that it could not fail to arrest my attention. If the air was simply mingled together between the two currents, blowing in different directions, I could see no reason for the great and rapid diminution of vapour in the regions below the clouds; for I have known the dew point to fall fourteen degrees, in the space of an hour, just before the rain commenced; though, as I afterwards ascertained, it was raining very hard during this very hour, within a few miles; and at another time it fell 20 degrees in 24 hours, before it began to rain, and when it began to rain it was about 30 degrees below the temperature of the air. By submitting these facts to a careful examination, I was enabled to form a true theory of rain, which I will communicate in a few words, after I shall have submitted Dr. Hutton's to a critical investigation. If any one will consider carefully, he may perceive that two currents of air may move in opposite directions, one above from the north, and one below from the south, for many hours and even days, without interfering much with each other's motion, or mingling together in any great degree. For the very central stratum of air between them will be stationary, and that on each side contiguous to this thin motionless stratum will move very slowly, and that a little further removed from the centre will move a little faster, until at the distance of a few yards, one hundred at most, the currents will move unimpeded and unmingled. I think any one who considers this case carefully and impartially, will grant that a stratum of 100 yards in thickness, is as much as could ever be mingled by different currents, moving even in opposite directions for many days. If this should be granted it will be manifest, that under the most favourable circumstances, when the currents of air mingled together were nearly saturated previous to their union—only a very thin cloud could be formed, which sinking down into the air below would be immediately dissolved if the temperature of this air should be at all above the dew point, which is always the case. But lest the position taken above should not be granted me, and some should think that a much larger quantity of air is mingled by different currents, let us put an extreme case, and suppose 1000 feet thick between the two currents, mingled together. Let us suppose also, what will certainly be allowed to be an extreme case, that these two currents differ in temperature 20 degrees, the temperature of the lower one being sixty, and the temperature of the upper one forty. Let us calculate, on known principles, how much water would be precipitated if both these currents had been saturated, previous to mixture. By examining the table at the end of this article, it will be seen that a cubic inch of air whose dew point is sixty, contains .00338832 grains of water, and a cubic inch whose dew point is fifty, contains .00246714 grains; wherefore a cubic inch whose temperature was reduced from 60 to 50 will precipitate the difference between these two quantities; that is, .00092118 grains, and the 500 feet in height will precipitate for every square inch of horizontal surface 6000 times .00092118, or 5.52708 grains. Moreover, a cubic inch of air of which the dew point is forty, contains .00178229 grains of water, and this subtracted from the quantity contained in a cubic inch whose dew point is fifty, as shown above, leaves .00068485 grains, which is the quantity that will be taken up for every square inch of horizontal surface and inch of perpendicular height of the 500 feet, whose temperature is elevated from 40° to 50°, giving a total of 4.10910 grains. Subtract this from 5.52708, the quantity precipitated from the 500 feet whose temperature was depressed, and there will remain 1.41798 grains, for the whole quantity of rain per square inch produced by this mixture of 1000 feet perpendicular height of air; not quite a grain and one-half on a square inch of surface: and even this small quantity would be diminished by a principle not taken into the account in the above calculation, namely, if two equal masses of air saturated with vapour of different temperatures be mingled together, the temperature of the mixture will be above the mean, for the vapour which is precipitated will raise the temperature by the evolution of latent caloric. Now as the lower portion of the atmosphere is never saturated with vapour, excepting when there is a fog, this minute portion of rain, as formed above, would not fall many feet in the air below, until the whole of it would be turned to vapour again, and none of it would reach the earth. Thus have I shown, by calculation from established principles, that rain could not be produced by the mixing of even much larger portions of atmospheric air, than are likely to be mixed by currents moving in different directions, even when these currents are saturated, a circumstance which seldom, or perhaps never, takes place in nature.

Another theory of less celebrity has been advanced by Mr. Morin. According to this author, rain can only be produced by compression of the air into a smaller space, as where it is forced against the sides of mountains by winds: or by refrigeration, caused by radiation from the cloud itself. Now most unfortunately for the first part of this theory—even if we grant that air is condensed by winds against the sides of mountains—experiment proves that the increase of heat by condensing air always *increases* its power of containing vapour.

And as to the second part of the theory—refrigeration by radiation from the cloud itself—it is defective in not accounting for the formation of the cloud. And even after a cloud is formed it is not at all likely that radiation from it is more rapid than from the surface of the earth in a clear night. Now we know from the phenomenon of dew that this radiation is too slow to account for the rapid formation of rain, as it occurs in nature.

It remains now to show the true cause of rain.

It is caused by the rush of the vapour itself, from the warm current of air where it is denser and more tense, into the cold current of air, where it is immediately condensed into water.

The proof of this depends upon two facts. First, the great discovery of Dalton, that vapour forms an atmosphere of its own, the particles of which press only on each other; and consequently the superior strata of vapour are not buoyed up by the atmospheric air, but are supported entirely by the elasticity of the vapour below; and secondly, the actual depression of the dew point sometimes just before a rain.

What resistance air makes to vapour passing through it, or what is the greatest velocity, with which vapour can pass through a given mass of air, with a given tension, I have not been able to determine; but that it does pass with considerable velocity, the falling of the dew point 14° in one hour, affords abundant proof. Now this rush of vapour, into the cold current of air, answers the purpose of mingling the two currents together, in producing a common temperature; for the vapour in condensing into water in the cold current, gives out its latent heat, and when it falls down into the warmer current below, it cools it both by its own temperature being lower, and by evaporating again, provided the current below is not saturated; and this process goes on, raining above, and evaporating below; the point of deposition ascending, and the point of evaporation descending, until finally the rain reaches the earth, just as the stratum below is cooled down very near the dew point. And this is what takes place in every rain which is caused by a cold current above, and a warm current below, moving in different directions. Lest I might be misunderstood, by a cold current above, I mean one colder than that which is due to the elevation, that is, more than one degree colder for every hundred yards of elevation. If a rain should occur from the warm current being above, and the greater density of vapour in it, then the dew point will rise before the rain —the vapour below being rendered more dense by the pressure of the superior quantity of vapour above.

But there is another way by which rain is produced, and that is by the gradual increase of vapour in the atmosphere, until it rises into a temperature too low to correspond with its density; for the elasticity of vapour being much greater than that of air, its density does not decrease in ascending as fast as the temperature; which has been fully illustrated by Mr. Daniell. Rain is produced by this cause, generally, in those parts of the torrid zone where it rains every afternoon. The vapour goes on increasing both in quantity and elasticity from heat, till the hottest part of the day, soon after which, the upper part of the vaporic atmosphere begins to condense into water, by being thrust up by its own elasticity, into a region of cold, below its dew point; and as the air below is almost saturated, the drops of rain coming down into it, colder than the vapour there, condense a portion of this vapour, and thus increase in size until they descend into air, whose dew point is four or five degrees below the temperature of the air, which is generally the case near the surface of the earth. The rains near the equator, where there can hardly be cold currents of air above, I think must all be caused in this way; but in our climate, we may expect to see rains often produced by cold currents of air overlapping warm ones—and such rains may always be predicted by the falling of the dew point. Every rain which occurred last April, was preceded by a fall of the dew point, from 6 to 24 hours before the commencement of the rain. During May, June and July, the rains have been of the equatorial character; the dew point has generally risen gradually to about seventy-two or three—that is within about two or three degrees of the mean temperature of the day, soon after which it commenced raining—sometimes with a slight fall of the dew point just before the rain—and only once with a sudden rise of three degrees, just before the rain commenced.

One phenomenon worth mentioning is, that on the 23d of June, I observed the clouds moving in different directions, the cirrus or upper clouds were coming from the south-west and the lower from the north. I have observed the upper clouds ever since that period (two days excepted, in which there were none,) constantly coming from that direction or from the west or some point between these extremes, and it is now the third of August. During this time the wind below has blown from every point of the compass. On the second of August, the lower clouds moved rapidly all day from the south, and the upper very slowly from the west, in the night there was some rain, and the next morning the lower clouds were moving rapidly from the north-west by north, and the upper clouds were moving from the south-west. Both these changes indicated to me that a great rain had taken place to the north. For when a large portion of vapour is condensed into rain, the diminution of volume which takes place can more easily be supplied by the subsidence of the air over the cloud, than it can by the air from the sides, which meets with much resistance from the obstacles on the surface of the earth. Therefore, the column of air immediately over the cloud will sink whilst it is raining, and the air at the surface of the atmosphere will run towards the cloud in all directions to restore equilibrium. Nor will it stop exactly at the moment when equilibrium is restored; it will accumulate where it was depressed before—the barometer will rise, and the air near the surface of the earth will be pressed outwards in all directions, from the region where it rained, and it will carry with it a great depression of the dew point—and some depression also of the temperature of the air. All these occurrences have taken place, and I anticipate, with great certainty, the report of a great rain on the night of the second of August, having occurred some place to the north of Philadelphia. I never yet have failed in predicting in what quarter the rain took place, when the phenomena were so marked as they have been in the present case. What I have said of the air being cooler, which blows from the rain, is not to be understood as recognising the principle, asserted by some writers, that it is colder because it comes from the upper regions of the air—*that*, I consider, I have demonstrated to be incorrect—it is colder because the rain descending from a great height cools the stratum of air under the cloud, and this is chiefly the air that diffuses itself laterally. Indeed, as was shown before, the air in the cloud itself during the condensation of the vapour into drops of rain, is made warmer by the evolution of the latent caloric of the vapour, and this is one reason, perhaps the only one, that a pound of air (I do not say a gallon,) contains more caloric in the upper regions, than a pound below. If I have not been successful in convincing gentlemen who have embraced the opposite doctrine, I will ask them to explain why, on their principles, the air ceases to blow downwards immediately after it ceases to rain? If the whole column of air is colder and denser in consequence of having descended, than the air surrounding it, which has not descended, it should continue to blow downwards for ever, on the principle of greater specific gravity; for the air would manifestly flow in above, to preserve the level at the surface of the atmosphere.

I do not purpose to enter upon the subject of the trade winds at present; but I may simply observe that if I have been successful in showing that any theory, to account for the semi-diurnal fluctuations of the barometer, which assumes for its basis an alternate increase and diminution of gravitating matter over the barometer, is utterly without foundation, Professor Mitchell will discover that it contains also a refutation of his doctrine of vortexes. Besides if I understand the Professor's reasoning, and also his statement that the air at the surface of the atmosphere in the torrid zone runs eastwardly from noon and not westwardly, it will follow, that the barometer will stand higher some time after noon—than some time before it—which is not the fact.

The able reviewer (Professor Renwick, I believe,) of Mr. Daniell, Am. Quarterly Review, for March 1828, will discover also that he was too hasty in admitting, that as soon as the sun heats the air hotter than that in surrounding parts, the barometer falls, and the air begins to move in all directions towards the heated part, when in fact the first effect of heating air is the very reverse of this, both as to the barometer and the motion of the air; for the barometer will rise, and the motion of the air will be in all directions from the centre of greatest heat; and before the current can begin to move the other way, the air must have had time to run off above, so that the mass of gravitating matter may be diminished over the heated part. This latter effect however will not have time to take place, if the point of greatest heat moves with a velocity of a thousand miles an hour; for then, as was shown above, the air will not have time to spread itself over surrounding regions. Professor Olmsted of Yale College, who has written on the causes of hail, will also perceive how easy it is to account for this meteor by admitting the fact that dense vapour in one stratum of air may permeate another stratum where it is less dense, and very cold, with great rapidity—which, independent of theory, is rendered very probable by my observations on the dew point. The French also may learn to lay aside their paragreles; for unless they can prevent cold strata of air from overlapping warm ones, or prevent the vapour from shooting up into these cold strata by its own elasticity, they will never be able to prevent hail.

As to the settling of moisture on a tumbler of cold well water, being a sign of rain, which is believed in many other places besides New Haven—there have been but seven days in the months of June and July, in which this would not have been given to any one who "seeketh after a sign," for the dew point was above fifty-five, the common temperature of well water, on every other day.

Notwithstanding the fallacy of the New Haven sign, it is to observations on the rise and fall of the dew point that we must look for means to predict the weather, and if this *point* is faithfully attended to, the result will be *success.*

The following table is extracted from the Edinburgh Encyclopedia—article Hygrometer, and is referred to in the preceding essay.

Temperature.	Weight, in grains, of the water in a cubic inch of vapour at the corresponding temperatures, Fah.	Temperature.	Weight, in grains, of the water in a cubic inch of vapour at the corresponding temperatures, Fah.	Temperature.	Weight, in grains, of the water in a cubic inch of vapour at the corresponding temperatures, Fah.
10	.00064161	34	.00146102	58	.00318197
11	.00066451	35	.00151051	59	.00328366
12	.00068825	36	.00156156	60	.00338832
13	.00071280	37	.00161424	61	.00349599
14	.00073810	38	.00166852	62	.00360679
15	.00076429	39	.00172454	63	.00372089
16	.00079136	40	.00178229	64	.00383826
17	.00081931	41	.00184189	65	.00395897
18	.00084819	42	.00190325	66	.00408317
19	.00087801	43	.00196651	67	.00421091
20	.00090882	44	.00203178	68	.00434230
21	.00094051	45	.00209899	69	.00447745
22	.00097337	46	.00216827	70	.00461639
23	.00100732	47	.00223878	71	.00475930
24	.00104235	48	.00231326	72	.00490628
25	.00107851	49	.00238903	73	.00505729
26	.00111588	50	.00246714	74	.00521259
27	.00115446	51	.00254757	75	.00537226
28	.00119420	52	.00263044	76	.00553634
29	.00123522	53	.00271574	77	.00570487
30	.00127758	54	.00280358	78	.00587810
31	.00132134	55	.00289415	79	.00605617
32	.00136636	56	.00298729	80	.00623919
33	.00141303	57	.00308325		

Description of Lieut. Cook's method of converting a Boat used for ordinary purposes into a Life Boat, at pleasure. Communicated by the inventor.

Notwithstanding that many plans for life boats for ships have been offered to the notice of the public, and that some have been partially introduced into the royal navy, to the best of the inventor's knowledge, there is not, at the present moment, a boat adopted by any service, whether British or foreign, naval or mercantile, calculated to despatch in a gale of wind, either to board a vessel at sea, to pick up a man who may have fallen overboard, or to send through a heavy surf to the shore, however great may be the case of emergency, although thousands of men have perished in such attempts!

To carry a life boat, in addition to the usual complement of boats, is out of the question; want of room alone is a sufficient objection. To take one, instead of another used for ordinary purposes, but which is not equally convenient and serviceable for common use, would also be objected to; while those plans which purposed to convert common boats into life boats, by moveable air tight cases, have been altogether thrown aside as cumbersome, and liable to the further objection of becoming waterlogged by the first sea that broke into them. It is then in the hope of having completely steered clear of the imperfections, which the opinion of nautical men attached to former ingenious contrivances, that the inventor respectfully offers to the notice of the maritime world at large, a very simple, cheap, and expeditious mode of converting *any* boat used for ordinary purposes, into a life boat, at pleasure, which cannot sink, nor become waterlogged, and into which, when a sea breaks, it will run out of itself, without exertion on the part of the crew. The invention is not one of problematical kind. It has been tried, officially tried, and most highly approved of, by an experienced and impartial officer, in a heavy surf on Deal beach, than which, a better place could not have been selected by the Hon. Navy Board. It was tried in the presence of officers of almost every rank in the navy, and in the presence of the first boatmen in the world, for whose use it is that Captain Pigot has recommended one to be kept on board the Gull-stream light. The Deal men declared it to be their conviction, that had they had a boat on this principle, 18 feet long, to have carried off in one of their large boats, to a vessel which was wrecked some time ago on the Goodwin Sands, the crew might have been saved; whereas, although eleven of the large boats succeeded in getting off, and actually anchored to windward of, and very near the wreck, it was only to have the melancholy and heart rending spectacle of beholding the crew drop from the rigging one after another into the sea; for owing to the broken water they dared not make any further effort to approach the perishing crew.

The invention consists principally in its having a neat shelf-piece of wood round the inside, level with the thwarts, about 5 inches wide by 1½ inch thick, containing a groove 2 inches wide, by half an inch deep, in the middle of which are metal pins or bolts, 18 inches apart, fitted with screws and finger nuts at their upper ends. By these, light metal battens, (fluted underneath, and of the dimensions of the groove,) are firmly secured down on the edge of the canvass deck, when spread, as will be hereafter explained. On a level with the shelf-piece, four or more small brass circular screw scupper plates, 3 inches in diameter, and of the thickness of the plank, are neatly let into the sides of the boat, so as to be perfectly water tight. Two others, rather larger in diameter, are fitted through the stern. These are the only material alterations, and so far from their having an unsightly appearance they are really ornamental.

The above description will serve to show how very little in appearance this boat differs from those now used for ordinary purposes; while in five minutes it can be converted into a life boat, simply by spreading over the canvass deck, which is intended to keep the water from getting below the thwarts when a sea breaks into the boat, and which, in doubtful weather, or on detached service, may be kept in a cloak bag under the fore sheets. The water which does not run over the gunwale, escapes through the scupper holes. The edge of the canvass is bound all round with thin leather. In the binding eyelet holes are worked, 18 inches apart, to correspond with the position of the pins or bolts in the groove, over which they are hooked previously to placing on the battens, which, when screwed down into the groove, effectually prevent the water from passing the edge of the deck.

Each rower has a bag sufficiently large to contain his legs, his feet being placed on the stretcher: opposite to him is a spare bag, which, until wanted, may be turned inside out, and rolled up. There are also spare bags in the stern sheets. In very large boats, such as launchers, an aperture in the deck might be provided, properly secured, of sufficient dimensions to admit the body of a man, so that in a gale of wind, on detached service, a part of the crew—the canvass not being air-tight—might rest under cover: or in fine weather, in tropical climates, while thus employed, the whole of the boat might be covered over, excepting the stern sheets, to protect the men from the rays of the sun by day, and from the dews by night.

Lest the boat should leak, or in the event of any water oozing through the canvass, a hand pump is provided to keep her free: provision is likewise made for stepping the masts when required.

The fenders, made of cork shavings, and in a canvass tube the whole length of the boat, are in their construction, as well as in their mode of application, extremely simple, and were greatly approved of at Deal, not only on account of the security they afford to the boat in going alongside a wreck, but on account of the additional stability they give; and on account of their capability to support the crew, should a hole by any accident be knocked through the bottom of the boat.

An iron keel is also provided, so fitted outside, that in the event of an emergency, such as knocking a hole through the bottom of the boat, it can be instantaneously detatched by pulling a trigger; other modes, however, of ballasting the boat, may be preferred by the different commanders of ships. The inventor names this for the information of such as may feel desirous of having it.

Explanation of the other inventions adverted to in Capt. Pigot's Report.

TACKLE FALL BLOCK.

Fig. 1.

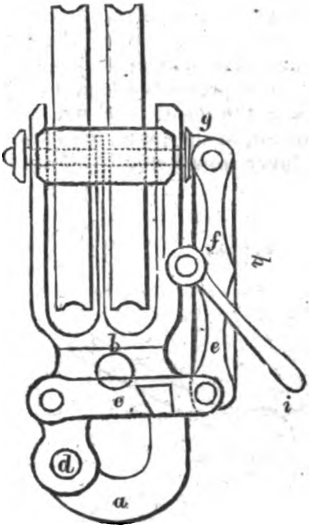


Fig. 1, is a view of the "tackle fall block," the object of which is to enable the crew to disengage the boat from the stern, or from both head and stern tackle falls in an instant, with such precision and certainty, as to remove the greatest part of the danger, connected with despatching a boat in a hurry, or in bad weather. *a* is the hook, the end of which rests firmly on the frame of the block *b; c* is the fork which keeps the hook from turning round at the joint *d; e, f,* are two legs, the former joined to the fork *c,* the latter to the pin of the block *g,* and are united together by a rule joint at *h.* While in their present straight position, they keep the fork, *c,* from liberating the hook *a;* but on the handle, *i,* being pulled, the legs *e, f,* form an angle like the dotted lines in fig. 4, when the fork releases the end of the hook, which instantaneously disengages the boat.

SHEET LIBERATOR.

Fig 2

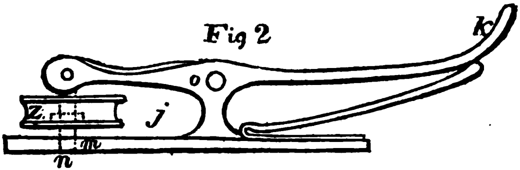
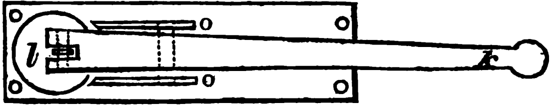


Fig 3



Figs. 2 and 3 are different views of the "sheet liberator." This simple apparatus effectually removes the necessity of employing men to stand by the sheets, when under a press of sail in boats in squally weather, and when their services may be much needed at the oars. It is no uncommon thing to hear of boats being found upset, with their sheets belayed. The inventor belonged to a frigate whose cutter was discovered in this situation; not one of the crew, consisting of an officer and thirteen men, escaped! all met with a watery grave. The liberator is fixed to the inside of the boat nearly in the position of fig. 3. The single part of the sheet is rove through the aperture *j*, and belayed forward. Should a sudden gust of wind take the sail, touch the lever *k*, and the shieve *l* turns round, relieving the boat, by releasing the bight of the sheet, without the danger of letting it fly. Although the shieve turns freely, it is prevented from coming off the spindle by a small nut. While in the position of fig. 2, the end of the spindle, *m*, rests in the socket, *n*, of the plate, the ears, *o*, of which, prevent the short end of the lever from being lifted up by the flapping of the sail.

BOAT'S GRIPES LIBERATOR.

Fig. 4.

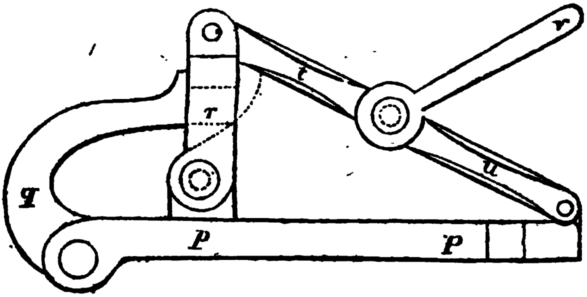


Fig. 4, is a representation of the "boat's gripes liberator." The plate *p*, is to be screwed or bolted to, and by, the edge of the mizen channels. The gripes being all of one piece, a thimble is to be seized into the middle or bight: this thimble is to be placed over the hook *q*, the end of which rests firmly on a stud cast in the plate *p*, to which the fork *r*, is bolted at *s*. The fork being kept in its perpendicular position by the two legs, *t* and *u*, as in fig. 1, it prevents the hook from turning round, until by pulling the handle *v*, it is permitted so to do. The two ends of the gripes are passed from the channels under the boat, brought up over the outer gunwale, and are set up by laniards as usual. It is evident that by casting off the bight or standing part, the boat is lowered down from under the gripes, and will clear herself should they be foul of the gunwale; whereas, by casting off the laniards, she is lowered down upon the gripes, and is sure of being turned bottom upwards, should their being entangled pass unobserved.

To prevent corrosion no iron is used.

[*Rep. Pat. Inv.*

Remarks on the Novelty and Utility required in an Invention, to be the Subject of a Patent, in England.—To the Editor of the London Journal of Arts.

Sir,—It is a generally received doctrine that an invention, to be the subject of a Patent, must be new and useful, but it is not so well understood what constitutes novelty and utility, and how far either or both must exist.

Mr. Holroyd, in his law of Patents, p. 19, says, "whether an invention be new and useful is a question of fact proper for a jury."

"But it may be safely laid down that whatever be the nature of an invention, whether the merit of it rests on discovery, or on improvement, novelty and utility must exist in a material degree."

Now inventions do not always contain novelty and utility in equal portions; but in some, novelty is predominant, in others, utility; in some the novelty is very great, the utility trifling, in others the novelty is just discernible, and the useful effect very great. And though it is very certain that the sum of the two must be considerable, yet it is not easy to say where the sufficiency of each begins. That can only be ascertained by examination of the case upon record, where the sufficiency of novelty and utility of invention, has been brought into question.

In some cases where Patents have been supported, the novelty of the inventions has been trifling, and the merit of the Patents, on the strength of which they were supported, was their great utility. For instance, in Huddart's Patent for rope machinery, the novelty *per se* was only trifling, (see Davis's Patent cases, p. 265.)

But however trifling it might be, it had a very important effect, for by virtue of it, Captain Huddart made better cables and cordage, than had been made before, and the Patent was supported.

Again, in Daniell's Patent of 1824, the invention was plunging cloth, made in the common way, into hot water, after it had been dressed; this would seem a very small amount of novelty, or invention, but its effect was to produce a great improvement in the cloth; and assuming it not to have been practised before, the Patent was held good, and J. Fussell who used steam instead of hot water, for the same purpose, was held an infringer, and his Patent repealed. (See Appendix to the Report of the Committee of Patents, p. 211, the King against Fussell.)

Again, in Brunton's Patent, for improvements in ships' anchors and windlasses, and chain cables or moorings. The difference between Brunton's chain cables and Captain Brown's (who had preceded him) was a trifle. Captain Brown made his cables with twisted links, a wrought iron stay being fixed across the middle of the opening of each link to keep them from collapsing. The links of Brunton's chain cables were not twisted, but made in the strongest form, and the stays across the links were made of cast iron, with broad ends adapted to the sides of the links, and embracing them. Brunton's links had come into general use for chain cables in place of Brown's, who himself had also adopted Brunton's links. The jury considered Brunton's chain cable new and useful; and afterwards on a motion for a new trial, the Lord Chief Justice, Abbot, confirmed their opinion as to the *sufficient novelty* of the chain cable, although he held the Patent bad on other grounds.—(See Appendix to Report of Patent Committee, p. 206.)

In all these cases the novelty was *per se* inconsiderable; but such as it was, by being combined skilfully with mechanism or processes known before, it went to produce important results in the shape of better cordage, chain cables, and cloth, than had been produced before; so that the public got really better things than they had had before the inventions: therefore, the inventions were held sufficiently new to comply with the law.

Absolute want of utility, or total failure in operation, of course avoids a Patent; as, however, such abortive inventions are rarely brought into court, there can be but few cases on record of decisions against them. But Patents have frequently been brought forward in court, grounded on inventions, in which the novelty has been more prominent than the utility, and in which the latter if not absolutely disproved, has failed to be established. Such patents have been generally brought forward merely as weapons of offence, to demolish other later patents for inventions founded on a similar principle, but differing somewhat in their practical combination and organization. As for instance, Balfour's Patent cited against Huddart's, in *Huddart* against *Grimshaw*.—(See Davies, p. 265, and Kirke and White's patent cited against Kneller's in *Hallett* against *Hague*.)

In most of these cases, the patents, which have taken a stand on their utility, have been maintained in spite of the preceding ones, which could not show utility; that is, the difference between the inventions, has generally been held sufficient to support the later patent.

It appears, therefore, from examination of the most important case, that utility is the quality most rigorously exacted by the law. For, first, an invention, however novel, which has not succeeded in practice, and has consequently been useless to the public, is not suffered to clog the operation of a subsequent invention which does succeed, and which though it may differ little from the first in appearance, differs from it in reality in something, by virtue of which it produces a better result, as in Huddart's case before cited, and in the late case of Hallett against Hague, tried in the Court of King's Bench, 26th of February, 1831.*

---

* In Hallett against Hague for an infringement of Kneller's patent,—Kirke and White had a patent, in 1822, " for a process for more rapid crystallization,

And, secondly, an invention which is held sufficiently new, and is also successful in practice, is supported against infringement by colourable evasions, as in the trials of Watt's patent; Clegg's patent for a gassmeter in Crossley against Beverley; and Daniell's patent in the King against Fussell.

Hence we may conclude, that when commanding utility is proved, a moderate share of novelty is sufficient to satisfy the law, because the utility is held *per se* novelty. For if an invention produces that which the public had not before, and which they prize highly, the *result* is the novelty, and it matters little in fact or in law, whether the means by which that valuable and new result is obtained, be trifling or not. It is not meant to be asserted, that a good machine or process possessing no novelty whatever, is merely on account of its goodness a subject for a patent; but it is barely possible, that a new effect, a result much better than previous results, can be obtained by virtue of no change whatever in the means; and if there is a change, although it be small, yet if its effects are great, and if it produces a beneficial result for the public, by giving them something real and useful, which they had not before, it may be expected, that a patent, grounded upon such change in the means, will stand firm as to novelty.

The truth is, that great novelty is becoming daily a more rare and difficult thing to attain;* and by reason of the minute subdivision that characterizes the present state of the useful arts, and the great extension of production in every branch of them, minute differences in the means employed, cause great difference in the results to the public. Hence there is value and merit in those minute differences; and it being daily more and more difficult to distinguish between them, we consider the results instead of the means, because

---

and for the evaporation of fluids at a comparatively low temperature." And Kneller took afterwards a patent for "certain improvements in evaporating sugar," &c.

It was contended by the defendants, who had the right of using Kirke and White's invention, that Kneller's specification described an invention essentially the same as Kirke and White's, although the construction of the one apparatus was somewhat different from that of the other; that hence, Kneller's apparatus came under Kirke and White's patent, and therefore, that they had a right to use Kneller's apparatus as a mere modification of their own.

It was proved that Kirke and White's invention had not come into use, and the defendants could not prove that it would answer the purpose, or was so effective as known methods of producing evaporation.

On the opposite side it was shown, that the difference between Kneller's invention and Kirke and White's, whether trifling or not, sufficed to make Kneller's apparatus answer the purpose; of which the proof was, that competent witnesses had tried it, and found it succeed upon experiment; and further, that it was in actual practice for trade at the plaintiff's sugar-house. Kneller's patent was supported against the infringement, and afterwards on a motion for a new trial, the verdict was confirmed by the court.

* This is not wonderful, considering that since the year 1675, 5539 patents have been granted (to say nothing of the inventions for which patents are not taken,) and considering further that hardly a month passes without two or three inventions on the same subject.

in the former, the good and the evil are magnified, so as to exhibit differences that the judgment can seize, as a microscope will make visible differences between things, that, to the naked eye, appear similar. [*London Jour. Arts.*

Cement from Iron Filings.

M. Mailtre having reflected upon the action of vinegar in the preparation of the cement known as *mastic le limaille*, which is made of iron filings, garlic, and vinegar, so proportioned as to form a mass of moderate consistency, proposed to substitute for the vinegar sulphuric acid, diluted with water, in the proportion of one ounce to a little more than two pints of water, and to reject the garlic as useless. This alteration was soon adopted by all to whom he communicated it in Paris, and will save, in Paris alone, more than ten thousand francs annually. This cement is there employed to close the seams of stones with which terraces are covered. The iron filings becoming oxidized, occupy a larger space—their oxidation being facilitated by the action of the acid, and the joints become exactly closed. [*Mechanics' Magazine.*

Mr. Collinge's Spherical Hinge.

Sir,—As it may not be generally known, that Mr. Collinge's spherical hinge is constructed upon the purest anatomical principles; and, as I am in the habit of illustrating my remarks upon the "mechanical structure of the human skeleton, compared with those of animals," in my popular lectures on that subject, by an exhibition of this invention, I deem it right to trouble you with a few observations on the structure of the hinge, and the joint it imitates. In doing so, I have no other object in view than to make more generally known the great ingenuity of the inventor; and to observe that this constitutes an illustration of the beneficial consequences that may result from the diffusion of that knowledge which teaches the component parts of animal bodies, which are well known to be constructed upon the truest mechanical principles.

The hip joint forms that species of articulation denominated, by anatomists, *enarthrosis*, or the ball and socket joint, by means of which the inferior extremity can be moved, in a circular direction, every way: the head of the thigh bone forming a large ball, which is received into a corresponding cup or cavity formed for its reception in the hip bone. Now this is exactly the mode of construction followed by Mr. Collinge, in his patent hinge. The resemblance is carried even farther. In the living joint a small quantity of synovia is secreted, by a series of diminutive glands, for the purpose of lubricating the surfaces in contact, and preventing the effects of friction. This is popularly, and not inaptly, called *joint oil;* though, in point of fact, it is not an animal oil, but resembles albumen, or white of egg. In Mr. Collinge's hinge there is, in the same way, an aperture to admit a small portion of oil at the top, with another at the bottom, for its escape, when a new supply is required; and, to complete the imitation of nature, the whole is constructed perfectly air-tight.

I understand this species of hinge is now extensively used for gates, rudders, &c. for which purpose I should conceive it to be excellently adapted.

Yours, &c.
W. H. Dewhurst, *Surgeon.*
Professor of Human and Comparative Anatomy.

Fig. 1.

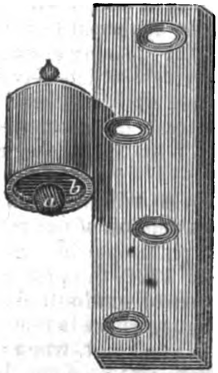


Fig. 2.

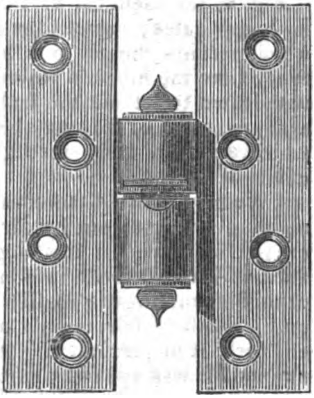


Fig. 3.

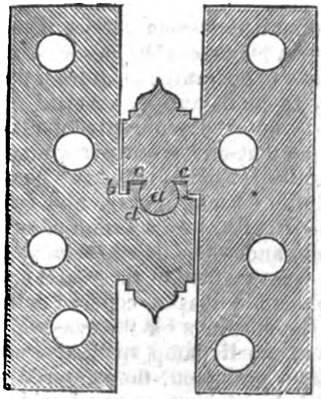
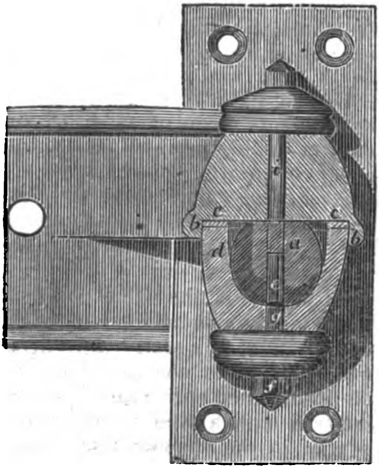


Fig. 4.



Description.

Fig. 1, is a perspective view of the upper half of a patent improved butt hinge; *a* shows the spherical bearing, which moves in a hemispherical cavity, made in the lower half of the hinge; *b* shows the recess, in which is placed a leather collar, to exclude air and dust.

Fig. 2, is an elevation of the same hinge, when the upper and lower halves are united.

Fig. 3, is a vertical section of Fig. 2; *a* the spherical bearing; *b*, *b*, the recess which contains the leather collar *c*, *c*; *d* the hemispherical cavity which contains the spherical bearing *a*, and also the oil necessary to lubricate the surfaces, and thereby prevent friction.

Fig. 4, represents a vertical section of parts of a hinge, suitable for heavy gates; *e* shows the groove formed in the spherical bearing, which permits the oil to flow up and lubricate the bearing surfaces every time the hinge is moved; *f* the head of a screw which may be withdrawn to let out the foul oil through the hole *g*; *h*, the head of a similar screw, that may be taken out when fresh oil is applied, which will run down through the hole *i*, and fill the hemispherical cavity *d*.

[We give above a more particular description of the invention so obligingly pointed out by Mr. Dewhurst, to the attention of our readers; it is, indeed, a most ingenious and very philosophical contrivance. We have been informed that, in the year 1798, the principle of this invention was applied to support an immense windmill shaft, on Sir Bethel Codrington's sugar estate in Antigua, where it remained, without inspection, nineteen years and a half; and that, when examined, it was apparent that the spherical pivot, and receiver, had never been in contact, the oil having kept their surfaces in a state of constant separation, and prevented all friction.—Ed. Mec. Mag.]

Protection of Firemen.

On the 4th of April M. Gregori communicated some details of the experiments recently made in Italy by the Marquess Origo, commandant of the firemen at Rome, with a view to guarantee them from the effects of entering houses while a prey to conflagration. Acting on the received opinion that the Romans employed a mixture of clay and vinegar to extinguish flames, he tried that mixture in every manner, but it produced no satisfactory result. He then dipped two complete suits of firemen's dresses, including boots, gloves, and two cowls, made of the same cloth as the dresses, in a solution of sulphate of alumine and sulphate of lime, and when dried, saturated them with soap water. Two firemen were clothed in these dresses, and their faces covered with incombustible masks, covered with cloth saturated with a saline solution; the openings for the eyes were covered with a web of amianthus, and small damp sponges were placed in their mouth and ears. Thus protected, they entered a house, 23 feet long and 3 feet wide, filled with burning wood, which they traversed ten times without the slightest injury. Their clothes were not damaged, although they had remained fifteen minutes exposed to the action of the flames. The only effect produced on the men was the increase of the pulsation from 70 to 125. These dresses cost but two pounds sterling each; and are, therefore, in that respect more eligible than those composed of amianthus, as recommended by the Chevalier Aldini. M. Origo also extinguished flames of considerable violence by playing on them with the solution of sulphate of alumine and clay, by means of a common engine.—*Royal Academy of Sciences of Paris.*

BIBLIOGRAPHICAL NOTICES.

A Treatise on Mechanics, by Captain Henry Kater, Vice President, Royal Society, and Rev. Dionysius Lardner, LL.D. F. R. S. L. & E.

THE above named work, which makes the fifth volume of Dr. Lardner's Cabinet Cyclopedia, has been reprinted both in Boston and Philadelphia. In this volume, the general properties of matter are explained in a clear and familiar manner; this, with The Laws of Motion; Gravitation; The Simple Machines, or Mechanic Powers; Wheel Work; The Means of Modifying Motion; Friction, and the Rigidity of Cords; The Strength of Materials; and an Investigation of the Nature and Uses of Balances and Pendulums, constitute the contents of the work. The different parts of the subject are treated without the introduction of mathematical formulæ, and the writers have been eminently successful in stepping down from the eminence on which they stand, to lead others up in the paths of science. The difficulty of doing this has been fully evinced in some of the numbers of the *Library of Useful Knowledge*, and other works intended for popular instruction, which, although they have evinced the learning of their authors, have too frequently been very illy adapted to the end proposed.

In the present work, the illustrations are very happily chosen; the beaten track has been departed from in many instances, so that those who have the popular treatises on mechanics upon their shelves, may still peruse this with real advantage. The chapter on Balances and Pendulums contains more direct and satisfactory information on these subjects than can be any where else found in the same compass.

The Academic Pioneer—conducted by the Editorial Committee of the Western Academic Institute, No. 1, Vol. I. Cincinnati, 1831.

We have just received the above pamphlet, and learn from it that the *Academic Institute*, consists of an association of teachers in the city of Cincinnati, formed for promoting the cause of general education. It is proposed by them to publish a monthly journal, at two dollars per annum, to diffuse such information as may be thought most conducive to the object in view. The number before us is intended to form the first of the series. Its contents are an Address by C. B. M'Kee; The Constitution of the Society; A Discourse on Education, by the Rev. Dr. Bishop, President of Miami University; Address by Mr. Alexander Kinmont; Officers; Prospectus, &c.

Although we do not find in either of the published addresses any thing particularly novel, or striking, and have to regret that in point of composition they are not more creditable to their authors, yet we rejoice to see the teachers of youth uniting together in order to pursue measures calculated to enlarge their own sphere of knowledge, and, of course, to promote the improvement of the pupils committed to their care.

Knowledge for the People, or the Plain Why and Because. By John Timbs, Editor of 'Loconics' Arcana of Science and Arts, &c. No. 1, 18mo. 72 pages, 12½ cts. Lilly & Wart, Boston.

This is a very good title to a very indifferent book. The Whys are in most cases well enough, but the Becauses are, in numerous instances, *non sequeters*, or tend to "darken council with words without knowledge." This "Knowledge for the People" proceeds upon the supposition that the people already know all about the meaning of oxygen, hydrogen, and other chemical agents, as well as many other things, which, if they did know, such a work as the author *intended* to produce, would be of very little value.

The first question is, "*Why are coke and charcoal fires free from smoke?*" and the reply, "Because their moisture has been previously dissipated; this moisture producing the smoke of coal fires." Should some schoolboy ask Mr. Timbs, why it is then that moistened charcoal does not smoke when put upon the fire, he would have to imagine some other Because before he could answer the question. Is it the moisture in pitch, tar, resins and oils, which causes them to smoke when burnt?

The next Because introduces 'gases,' 'active caloric,' 'latent heat,' 'radient heat,' &c. &c. as familiar acquaintances of *the people*. We have a very intelligent community in the United States, but the great body of the operative classes of England must leave ours far in the rear, if they can derive instruction from Becauses thus constructed.

At page 4, we have "Why does sunshine extinguish a fire? Because the rays engage the oxygen which had hitherto supported the fire." We really know not what kind of engagement is here intended; for although the sun is introduced, and actively concerned in the contest, he does not throw any light upon the subject.

At page 5th we learn, that sulphur thrown upon a fire not only decomposes the atmospheric air, but absolutely *annihilates* it.

We might notice similar absurdities, on almost every page, intermixed, it is true, with some good Becauses, borrowed from Arnott, and others, and possibly, in some instances, supplied by the author himself.

Should the parts which are to follow manifest as little tact at explanation, and as much ignorance of the subjects to be explained, we hope that the American publishers will cause them to be expurgated and remodelled, before they are placed in the hands of our 'People.'

Since writing the foregoing we have seen two additional numbers, the 2nd and 3d, of the Plain Why and Because; the second is devoted to Zoology, the third to Origins and Antiquities. In point of general correctness they are to be preferred to the first number, but still we find in them but little to praise, or to approve. The same want of plainness in the Becauses, pervades the whole, and interferes with the utility of the work. The number on origins and antiquities, relates principally to manners and customs in England upon points but little understood, and possessing but little interest, in this country.

Scientific Tracts designed for instruction and entertainment, and adapted to Schools, Lyceums, and Families; conducted by Josiah Holbrook and others. $1 50 per annum for twenty-four numbers in 12mo. 24 pages each, Carter & Hendee, Boston.

We have seen thirteen numbers of this publication, and although upon the whole we think favourably of the work, there are some parts of it which are not skilfully managed, and several inaccuracies in point of fact. The second number, treating upon Geology, may be cited as a proof of the latter, as it ascribes to this science what belongs to mineralogy and chemistry. We are told, for example, that geology "has brought to view inexhaustible deposits of the material for the manufactory of the beautiful pigment under the name of chrome yellow;" and again, that "it has led to the establishment of a manufactory of epsom salts, where seven or eight hundred tons are made in a year!" It certainly was not by the aid of geology that either the chromate of iron, or the magnesian mineral referred to was discovered, nor did it suggest the preparations made from them.

In the number treating of the atmosphere we are told that "from the reflective power of the atmosphere we derive the delightful twilight before the sun rises, and after he has passed from our view." Here reflection is manifestly put for refraction. It is also said that "the atmosphere extends to nearly fifty miles from the surface of the earth." We are unacquainted with its extent, but have abundant reasons to conclude that it greatly exceeds the limit here assigned. Such a statement might be justified by a reference to the older writers on natural philosophy, but is altogether inconsistent with our present views upon this subject.

Notwithstanding these objections, there are some of the numbers of this work which we think merit unqualified praise. The 5th, on the Eye, and the 12th, on the Ear, both written by Jerome V. C. Smith, M. D., are particularly excellent.

Meteorological Observations for November, 1831.

Moon.	Days.	Therm.		Barometer.		Dew point	Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2 P.M.		Direction.	Force.		
				Inches	Inches.				Inches.	
	1	42°	52°	29.60	29.60	42	W.	Moderate.		Clear day.
	2	40	52	.80	.80	40	W.	do.		Clear—flying clouds.
	3	38	50	.96	.94	36	W.	do.		Clear day.
⊗	4	34	54	.94	.90	36	N. S.	do.		White frost—clear—cl'dy
	5	38	52	30.00	30.00	30	NW.	do.		do do clear.
	6	32	50	.10	.10	36	W.	do.		do do clear: cl'dy.
	7	38	56	29.95	29.90	37	W.	do.*		do do clear.
	8	42	52	30.10	30.10	31	W.	do.		Clear day.
	9	42	56	.10	.10	41	E.	Calm.		Cloudy—hazy.
	10	48	64	.05	29.94	46	E. S.	do.	.43	Fog—cloudy; rain night.
	11	58	60	20.70	.70	56	SW. W.	High.		Cloudy—clear.
☽	12	38	50	.83	.83	35	W.	Moderate.		Clear—cloudy.
	13	36	48	.80	.60	33	W. SW.	do.		Cloudy—clear.
	14	42	50	.55	.55	37	W. NW.	Blustering.		Cloudy—flying clouds.
	15	40	48	.63	.65	32	NW.	do.		Flying clouds—clear.
	16	34	46	.65	.70	27	NW.	do.		Frost—clear.
	17	32	48	.70	70	31	NW.	Moderate.		Clear day.
	18	38	42	.60	.50	39	E.	do.	.31	Cloudy; drizzle. Rain n't.
☺	19	40	44	.50	.30	32	W.	Blustering.		Clear day.
	20	38	46	.60	.60	32	W.	Moderate.		White frost—clear.
	21	30	52	.60	.50	33	E. SE.	Blustering.		Do clear; cl'yd; rain even-
	22	32	36	28.82	.00	35	W.	do.	.45	Snow, wind high. [ing.
	23	31	42	29.60	.75	26	NW.	do.		Flying clouds.
	24	31	42	.90	.94	26	W.	do.		Clear day.
	25	29	42	30.00	30.00	26	W.	Moderate.		Clear day.
☾	26	32	35	.00	29.85	34	NW. SE.	do.	.03	Cloudy; snow; hail.
	27	38	42	29.95	.90	40	SE. W.	Blustering.	.43	Rain; cloudy.
	28	33	33	.54	.60	22	NW.	do.		Flying cl'ds; clear; light
	29	25	27	.50	.50	10	W.	do.		Clear day. [snow n't.
	30	20	32	30.00	.90	12	W.	Moderate.		Clear day.
	Mean	36.40	46.77	29.77	29.75	33.1			1.65	

		Thermometer.	Barometer.
Maximum height during the month,		64. on 10th.	30.10 on 6,8,&9th.
Minimum	do.	20. on 30th.	28.82 on 22nd.
Mean	do.	41.58	29.26

ERRATA.

Page 147, for continued from p. 40, read continued from p. 89.

There are some other obvious errors; at the distance of the editor from the press, this is unavoidable.

INDEX.

AMERICAN PATENTS, LIST OF, WITH EDITOR'S REMARKS, &C.

			PAGE.
	March, 1831.		
1.	Rifles for sharpening edge tools,	Peleg Barlow,	8
2.	Oval axe machine,	Stephen Hyde,	ib.
3.	Lamp, improved	Lewis F. Gallup,	9
4.	Stove for anthracite,	Stephen C. Roe,	ib.
5.	Rail-roads and cars,	Emmor Kimber,	ib.
6.	Raising vessels for repair,	Joshua Cleeves,	ib.
7.	Knitting machine,	J. M'Mullin & J. Hollen, jr.	10
8.	Thrashing machine,	J. C. Gentry,	ib.
9.	Stereotype blocks,	Bradbury Hackett,	11
10.	Thrashing machine,	Fayette Cross,	ib.
11.	Propelling rail-way carriages,	Abraham Pawling,	ib.
12.	Malleable iron, making	Seth Boyden,	12
13.	Applying water to wheels,	Joseph Michener,	ib.
14.	Gas metres,	H. Robinson,	ib.
15.	Door knockers,	Increase Wilson,	13
16.	Cutting wooden screws,	John Morrison,	ib.
17.	Paper making,	Solomon Stimpson,	ib.
18.	Loom, improved	G. Deterick & J. Conger,	14
19.	Grinding apples,	Silas Freeman,	ib.
20.	Boilers, preventing explosions,	William A. Turner,	ib.
21.	Grooving sheet metal,	John Woolley,	15
22.	Steam engine boiler,	Samuel Forbes,	ib.
23.	Grist mill,	Joseph Yeamans,	16
24.	Lamps, improved	J. W. Shulze & J. Trull,	ib.
25.	Trusses for Hernia,	Jesse C. Earle,	ib.
26.	Boot making machine,	Nicholson Mills,	17
27.	Augur,	George Shetter,	ib.
28.	Thrashing machine,	Abraham W. Summers,	ib.
29.	Splitting leather,	Augustus S. Dawley,	18
30.	Lamps, hanging, improved	William Lawrence,	ib.
31.	Wheel carriages,	Henry Chapman,	ib.
32.	Alloy for sheathing ships,	John Revere,	19
33.	Steam boats for rapids,	Thomas Blanchard,	ib.
34.	Mixing paint,	Jonathan Linnell, jr.	20
35.	Brick pressing machine,	A. M'Clung,	ib.
36.	Loom for Webbing, &c.	A. G. Bill & G. Spalding,	ib.
37.	Lotteries, constructing and drawing	J. K. Casey,	ib.
38.	Brick pressing machine,	John Sites,	ib.
	April, 1831.		
1.	Washing gold ore,	John Powell,	108
2.	Thrashing machine,	G. Conde & J. Tousey,	ib.
3.	Wood screws, machine for	Hazard Knowles,	ib.
4.	Laths, cutting by circular saw,	Chaning Madison,	109
5.	Metallurgical operations,	Richard Wilcox,	ib.

		PAGE.
6. Metallurgical operations,	Richard Wilcox,	109
7. Metallurgical operations,	Richard Wilcox,	ib.
8. Washing machine,	M. D. Mulford,	110
9. Thrashing and cleaning wheat,	Samuel Lane,	111
10. Malleable iron, manufacturing	Seth Boyden,	ib.
11. Glass frames for pictures,	John Scott,	ib.
12. Rags, washing for paper,	John Ames,	ib.
13. Scoop shovel,	E. Mudge & R. Tenny,	ib.
14. Boilers, preventing their bursting,	William A. Turner,	112
15. Coke from anthracite,	Moses Isaacs,	ib.
16. Metronome for music,	Uri Emmons,	113
17. Boiler for liquids,	Richard M. Beach,	ib.
18. Spades and shovels, making	C. Richmond & S. Caswell,	ib.
19. Press,	Luther Carman,	ib.
20. Churning by air,	Elias V. Coe,	ib.
21. Scythe sneaths, bending	John Knight,	114
22. Horse shoes, machine for	David Anthony, jr.	ib.
23. Fire, blowing by steam,	Joel Eastman,	115
24. Thrashing machine,	William B. Marks,	116
25. Mills, improved	Elias Davis,	ib.
26. Corn shelling machine,	Jabez Parker,	ib.
27. Propelling boats, mills, &c.	A. Parkhurst & S. Bacon,	117
28. Rendering articles water proof,	George H. Richards,	ib.
29. Mixing clay or mortar,	Aaron Parkhurst,	ib.
30. Washing or churning machine,	John White,	ib.
31. Smut machine,	Levi Hayward,	118
32. Water wheel,	Martin Coney,	ib.
33. Stone breaking machine,	Benjamin F. Lodge,	ib.
34. Congress spring water, imitation of	William Meade,	119
35. Corn shelling machine,	J. Barnes & N. T. Loomis,	120
36. Thrashing machine,	Newton C. Munroe,	ib.
37. Propelling wheels, for boats,	Phineas Palmiter,	121
38. Gas lamps, self-generating	Solomon Andrews, M. D.,	ib.
39. Jointing staves for barrels,	George Eby,	ib.
40. Constructing ships,	R. Deming,	122
41. Tubs, &c. without staves,	John Patridge,	ib.
42. Power, generating	Samuel Kilburn,	ib.
43. Teaching arithmetic,	Oliver A. Shaw,	123
44. Marine rail-way,	Joralmon & Lockman,	ib.
45. Rotary pump,	Jedediah Beckwith,	124
46. Rotary steam engine,	Abel Greenleaf,	ib.
47. Hollow ware of zinc,	Samuel Davis,	ib.
48. Fire ladder and escape,	James Johnson,	125
49. Couches, sofa, &c.	Charles Adams,	ib.
50. Door locks,	Andrew Wolfe,	126
51. Machine for cleaning fur,	William Woodworth,	ib.
52. Casting lead pipes,	Burroughs Titus,	ib.
53. Boat for canals,	Samuel D. Ingham,	ib.
54. Thrashing machine,	William J. Wood,	127
55. Grist mill, self-stopping	Robert M'Cormick, jr.	163
56. Washing machine,	John Hale,	ib.
57. Toggle joint press,	John Hale,	164
58. Polishing and graining leather,	Robert Emes,	ib.
59. Sheaves for blocks,	C. Curtis & T. C. Smith,	ib.
60. Churn,	David Smith,	165
61. Power loom,	J. Taylor & J. Woodhead,	ib.
62. Tanning,	Isaac Daws,	ib.
63. Washing machine,	John G. Conser,	ib.

		PAGE.
64. Teaching on the violin,	Robert M'Cormick, jr.	166
65. Thrashing machine,	Andrew Richison,	ib.
66. Horse shoes,	John Dietz,	ib.
67. Piano fortes,	Ebenezer R. Curcier,	167
68. Stumps of trees, extracting	Willard Foster,	ib.
69. Ink holder,	Daniel Harrington,	ib.
70. Mill spindles,	James Barton,	168
71. Invalids exercise machine,	Daniel Harrington,	ib.
72. Gold washing machine,	Green B. Palmer,	169
73. Splitting leather,	Alpha Richardson,	ib.
74. Dressing Woollen cloth,	Calvin W. Cook,	170
75. Rail-road carriages,	William Howard,	ib.
76. Thrashing machine,	O. Dean & J. Woodhull,	ib.
77. Dogs for saw mills,	Anson Andrews,	ib.
78. Thrashing machine,	Joshua S. West,	171
79. Thrashing, shelling, and grinding machine,	Alonzo L. Smith,	ib.
80. Thrashing machine,	Edmund Warren,	172
81. Saw trimmer,	J.R.Failing & R.G.Nellis,	ib.
82. Cold slaw and beef cutting machine,	Henry Bangs,	ib.
83. Ship timber, dressing	John Judge,	ib.
84. Propelling vessels and carts,	John J. Giraud,	173
85. Gumming saws, machine for	Phineas Newton,	ib.
86. Amalgamating and washing gold,	James L. Montaudevert,	ib.
87. Propelling wheel,	Asa Waters,	174
88. Thrashing machine,	William E. Osborne,	ib.
89. Grinding, levelling, and polishing metals,	William J. Stone,	ib.
May, 1831.		
1. Card teeth, cutting and setting	Reuben Meriam,	175
2. Distilling,	James L. Jenks,	ib.
3. Steam engine,	Philo C. Curtis,	ib.
4. Cutting grass and grain,	William Manning,	ib.
5. Stoves for stone coal,	Urban B. A. Lange,	ib.
6. Bark mill,	Merrit Hurd,	ib.
7. Soda water, drawing, &c.	Justus Perkins,	176
8. Grist mill, plantation	John Anderson,	ib.
9. Mould candles, making,	Thomas Hewitt, jr.	ib.
10. Boots and shoes,	Caleb A. Ore,	177
11. Piano forte action,	John F. Nunns,	ib.
12. Medicine,	Joseph Baker,	ib.
13. Churn,	Joseph Crail,	178
14. Gas, generating,	Solomon Andrews,	ib.
15. Animal tread mill,	William E. Arnold,	ib.
16. Thrashing machine,	Samuel Fahrney,	ib.
17. Blowing machine,	Daniel Strobel, jr.	179
18. Concentrating sirop or cane juice,	Daniel Strobel, jr.	ib.
19. Making beer, composition for,	Stephen Hinds,	ib.
20. Mill for grinding grain,	J.P.Phillips & J.Holliday,	ib.
21. Lifting ships, for repair, &c.	T. Evans & J. Parsons,	ib.
June, 1831.		
1. Portable grist mill,	J. & D. C. Ambler,	249
2. Effervescing mixture apparatus,	J. Ambler, jr.	ib.
3. Rail-way carriage,	William Bryant,	250
4. Corn shelling and cleaning grain,	Ezra Bond,	ib.
5. Mechanical fan,	James Barron,	ib.
6. Churner, complete	Cyrus Baker,	251
7. Spinning cotton, machine for,	John Brown,	ib.
8. Cart for removing earth,	George Coolridge,	252
9. Meat chopping and pulverizing machine,	B. P. Coston,	ib.
10. Reacting water wheel,	Jeremiah Case,	253

PAGE.
11. Thrashing machine, Rinaldo P. Gillet, 330
12. Making wooden clocks, Orsimus R. Fyler, 331
13. Washing rags for paper, D. & J. Ames, 332
14. Standing press, Charles Evans, ib.
15. Combined steelyards, Martin Rush, ib.
16. Drilling stones, Jonathan Crane, ib.
17. Hanging mill stones, Mark L. Chase, ib.
18. Purifying oil, John L. Embree, 333
19. Wood buttons, making De Grasse Fowler, ib.
20. Oil, substitute for Isaiah Jennings, ib.
21. Washing machine, Samuel Jinkham, ib.
22. Planing and grooving machine, John Judge, ib.
23. Locks for guns, Abel Judson, ib.
24. Corn shelling machine, David Hitchcock, 334
25. Hardening hat bodies, Stephen Hurlbut, ib.
26. Candle moulds, Thos. Hewit, Jr. ib.
27. Twisting tobacco, John J. Heriges, 335
28. Rotary steam engine, E. R. Hale, ib.
29. Corn shelling machine, William Hoyt, ib.
30. Window shutter fastenings, W. H. Mackrell, ib.
31. Distilling and evaporating, Alex. Matthews, 336
32. Obtaining alcohol, &c. Isaiah Jennings, ib.
33. Coal, ornaments from Josiah W. Kirk, ib.
34. Churn, Philip H. Kimball, 337
35. Separating seed, &c. Abel Look, ib.
36. Mortising machine, Henry Marsh, ib.
37. Hill side plough, C. H. M'Cormick, 338
38. Rail-ways and carriages, Alex. M'Grew, ib.
39. Destroying insects, &c. Joseph Nicolas, ib.
40. Making iron, John Patterson, ib.
41. Paddle wheel and boat, Benjamin Phillips, 339
42. Window blinds, Nathan Palmer, ib.
43. Friction rollers, John J. Reekers, 340
44. Soda fountain, Alonzo S. Smith, ib.
45. Pump, Daniel Smith, ib.
46. Sizing and napping hats, David Sutton, ib.
47. Planing and grooving boards, Jacob Tees, 341
48. Horse power engine, Isaac Van Doren, ib.
49. Washing, pressing, ironing, &c. machine, John Newhall, 342
50. Weighing machine, T. & E. Fairbanks, ib.
51. Moulding and docking crackers, J.P. Fairlamb&M.Dunott, 343
52. Paste for sharpening tools, Peleg Barlow, ib.
53. Thrashing machine, Isaac Van Doren, ib.
54. Throstle spinning, improved J. Brown & J. Standish, ib.
55. Steam lever rotary, J. Catlin & C. Fletcher, 344
56. Pendulum cradle, John M'Kenney, ib.
57. Churn, Samuel Sweet, ib.
58. Washing machine, John Appleton, 345
59. Winnowing mill, Moses Elliot, ib.
60. Cutting crackers, J. Clark & H. Henderson, ib.
61. Piano fortes, T. Kearsing & Sons, ib.
Academic Pioneer, 417
Air stove apparatus—*patent*, 140
——, evaporating fluid by—*patent*, 201
Alcohol from dough, oven for procuring 261
——— grain, &c.—*patent*, 347
Alloy for sheathing ships—*patent*, 28
American Journal of Geology, &c. 143
——— Institute of Instruction, discourse, &c. before the 213

PAGE.
American Library of Useful Knowledge, 241
Anthracite, drying tobacco by 5
———, smelting iron ore with 231
Axles, on bent, and on dished wheels, 96

B

Baker's improvement in medicine—*patent*, 186
Balance, economical and delicate, 217
Barilla, Woad, and Madder, on 208
Beer, composition for making—*patent*, 194
Biscuit baking by steam 64
Blasting rocks, Hare on 232
Blowing machinery for forges, &c.—*patent*, 191
Boat, common, converted into a life boat, 407
Boats on canals, rapid movement of 92
———, &c. improvements in—*patent*, 260
Boilers, height of water in 145
———, apparatus for steam engine—*patent*, 185
———, explosions in steam 234, 289, 306
———, experiments with low pressure, 210
British tapioca—*patent*, 30
Bullet retained in a gun by the finger, 69

BIBLIOGRAPHICAL NOTICES.

Discourse and Lectures to the American Institute of Instruction, 213
Working Man's Companion, Part 1, 214
American Library of Useful Knowledge, ib.
New Conversations on Chemistry, 215
Lardner and Kater's Mechanics, 417
Academic Pioneer, ib.
Plain Why and Because, 418
Scientific Tracts, 419

C

Calico printing, fusible plates for 50
——— printers, mordant for 52
Candles, making—*patent*, 351
Canals, rapid movement of boats on 92
Cane juice, concentrating—*patent*, 193
———, extracting sirop from—*patent*, 197
Caoutchouc, fluid—*patent*, 131
——— protectors for horses' legs—*patent*, 259
Cap spinner, Thorp's running 219
Carpenters' hold-fast, 287
Carriages, &c. locomotive—*patent*, 22
———, oiling rail-way 160
Casey's mode of drawing lotteries—*patent*, 26
Cast and wrought iron, durability of 281
Cement from iron filings, 414
Chain and rope cables, strength of 90
Chimneys, improvement in—*patent*, 257
Chronometers, oil for 212
———, tempering wires for 285
Circle, editor on the quadrature of the 1
Clement's experiment, mode of repeating 68
Cloth, emery 66
———, &c. dressing woollen—*patent*, 180
Cocoons, Duponceau's letter accompanying, 315
Conversations on chemistry, new 215

PAGE.

Cutting leather, machine for—*patent*, 23
——— grass, &c. machine for—*patent*, 195
——— and perforating glass, on 358
Cylinders of iron or steel—*patent*, 257

D

Distillation, applying heat in—*patent*, 352
Dough, oven for procuring alcohol from 261
Drawer knobs, fastening for 247
Dressing woollen cloth—*patent*, 180
Drying tobacco by anthracite, 5
Dungey's hold-fast, 287
Duponceau's letter accompanying cocoons, 315
Dye, new 142

E

Editor on the quadrature of the circle, 1
Editor's bibliographical notices, 213, 417
——— remarks on American patents for March, 1831, 8
——————————— April, 108, 163
——————————— May, 175
——————————— June, 249, 330
Emery cloth, 66
Engines, on the construction of locomotive 271
———, on wheels for locomotive 352
English patent laws, 276
Engraving, preparing plates for—*patent*, 183
Evaporating pan—*patent*, 193
——— fluids by air—*patent*, 201
Explosions of steam boilers, 234, 289, 306, 374
Experiments with the low pressure boiler, 210

F

Firemen, protection of 416
Fluids by air, evaporating—*patent*, 201
Forges, &c. machinery for blowing—*patent*, 191
France, ordinances of, on steam engines, 32
Fur, machine for cleaning—*patent*, 134
Fusible metal for calico printing, 50

FRANKLIN INSTITUTE.

Monthly meetings, minutes of 6, 104, 160, 248
Quarterly meeting, do. 319
Thirty-first quarterly report, ib.
Report of committee on water power, 73, 147, 221, 296, 367
——————— premiums, &c. 320
——————— inventions on a machine for cutting bungs, 106
——————————————— making sash, ib.
——————————————— Smith's revolving timber plane, 161
Communications to the committee on explosions in steam boilers:
  Report of the committee, 234
  Report of a committee on steam boats, 235
  Circular letter from the committee, 237
  Reply of Dr. Cooper and others, ib.
  Letter and queries, 239
  Reply of Dr. Cooper, 240
  ——— Frederick Graff, 241
  ——— Jacob Perkins, 242
  Letter from Col. Long to the committee, 244
  ——— General Swift, 306
  ——— W. S. C., 307

PAGE.

Letter from W. Littlefield, 308
———— a Gentleman, 310
———— M. Robinson, 310, 314, 315
———— E. W. Benton, 312
———— L. Hebert, 374
———— Thos. W. Bakewell, 382, 388

G

Gas, lighting with—*patent*, 141
—— generator—*patent*, 188
—— lamp, improvement in—*patent*, 189
—— lighting, improved mode of—*patent*, 258
—— for illumination—*patent*, 349
Gensoul's steam apparatus, 317
Glass, on perforating and cutting, 358
Glazing horticultural buildings, &c.—*patent*, 30
Grain, &c. alcohol from—*patent*, 347
Grass, &c. machine for cutting—*patent*, 195
Gun, bullet detained in by the finger, 69

H

Hanging paper, manufacturing—*patent*, 253
Harbours, on constructing, 355
Hare on blasting rocks, 232
Heat in distillation, applying—*patent*, 352
Hinge, spherical 414
Hold-fast for carpenters, 287
Horses' legs, protectors for—*patent*, 259

I

Illumination of light houses, 67
Insects and plants, destroying noxious—*patent*, 349
Iron, smelting and making—*patent*, 196
—— ore with anthracite, smelting, 231
——, cylinders of steel or—*patent*, 257
——, durability of cast and wrought 281
—— filings, cement from 414

J

Jet of water under water, 69
Johnson's rotascope, 361
Journal of geology, &c. American 143
"Justice," Shaw on a paper signed, 154

K

Knobs, fastening for drawer, 247

L

Lamps, improved—*patent*, 21
———, new 70
———, gas, improvement in—*patent*, 189
———, improvement in—*patent*, 196
Laws, on the English patent 276
Leather, machine for cutting—*patent* 23
Lester's pendulum steam engine, 98
Lever, spiral, for propelling vessels—*patent*, 161
Life boat, common boat converted into, 407
Light-houses, illumination of 67
———, measuring intensity of 68
Lighting with gas—*patent*, 141
Lights, generator for gas—*patent*, 188
Lighting, improved mode of gas—*patent*, 258
Locomotive carriages, &c.—*patent*, 22
———— engines, on the construction of 271

PAGE.

Locomotive engines, on wheels for, 352
Lotteries, Casey's mode of drawing—*patent,* 26
————————, remarks on 207

M

Machinery, results of 55
Madder, woad and barilla, on 208
Matheson on constructing harbours, 355
Mechanics, Kater and Lardner's 417
Medicine, improvement in—*patent,* 186
Metal plates for calico printing, fusible 50
Metallic sheathing for ships—*patent,* 137
——— wires, tempering 285
——— plates, grinding, &c.—*patent,* 183
Meteorological observations, 72, 144, 216, 288, 360, 420
————————, Espy on 389
Moll on the invention of telescopes, 41
Mordant for calico printers, 52

N

Notices, editor's bibliographical 213, 417
Novelty and utility required in patents, 411

O

Observations, Meteorological, 72, 144, 216, 288, 360, 420
Oiling rail-way carriages, 160
Oil for chronometers, 212
——— burning, substitute for—*patent,* 347
Oven for procuring alcohol from dough, 261

P

Paint, mode of mixing—*patent,* 25
Paper, machinery for making 70
———, made by machinery—*patent,* 140
———, manufacturing hanging—*patent,* 253
Patents, American, specifications of 21, 127, 180, 346
———, English 30, 137, 196, 253, 349
———, on the novelty and utility required in 411
Patent laws in England, 276
Pendulum steam engine, 98
Perforating and cutting glass, on 358
Photometer for measuring light, 68
Piano forte, improvement in—*patent,* 199
————————, 256
Pipes of lead, &c. casting—*patent,* 136
Plants and insects, destroying noxious—*patent,* 349
Plates for engraving, preparing—*patent,* 183
Potash from certain minerals, 70
Press, friction roller standing—*patent,* 129
———, improved standing—*patent,* 346
Protectors for horses' legs—*patent,* 259
Protection of firemen, 416

Q

Quadrature of the circle, editor on the 1

R

Rail-roads, &c.—*patent,* 22
Rail-way carriages, oiling 160
Rags, machine for washing—*patent,* 127
————————, 348
Results of Machinery, 55
Ritchie's economical balance, 217
Rocks, Hare on blasting 232

PAGE.
Rope and chain cables, strength of . . 90
Rotascope for illustrating rotary motion, . . 361

S

Saddles, improved—*patent*, . . . 30
Sails of ships, making—*patent*, . . 201
Scientific Tracts, . . . 419
Screw for propelling vessels—*patent*, . . 181
Sealing wax, improved—*patent*, . . 199
Shaw on the paper signed "Justice," . . 154
Ships, alloy for sheathing—*patent*, . . 28
——, &c. mode of building—*patent*, . . 132
——, metallic sheathing for—*patent*, . . 137
Sirop, concentrated by steam—*patent*, . . 193
Smelting and making iron—*patent*, . . 196
———— iron ore with anthracite, . . . 231
Spades and shovels, mode of making—*patent*, . 128
Spherical hinge, . . . 414
Spinner, Thorp's running cap . . . 219
Spirit from grain, &c.—*patent*, . . 347
Standing press, improved—*patent*, . . 129
————————————————, . . 346
Steam engines, French ordinances on . . 32
——, biscuit baking by . . . 64
—— engine, Lester's pendulum . . . 98
—————— boiler, apparatus for—*patent*, . 185
——, on the use of surcharged . . . 264
—— boilers, explosions in . . 287, 306
——————, height of water in - - - 145
——————, experiments with low pressure - 210
—— apparatus for silk filatures, - - 317
Steel or iron cylinders—*patent*, - - 257
———— evaporating pan—*patent*, - - - 193
Sugar, mode of making—*patent*, - - 31
——, making and purifying—*patent*, - - 32
——, curing raw—*patent*, - - - 140
—— from cane juice, extracting—*patent*, - - 197
—— cane, culture and manufacture of - - 201

T

Tapioca, British—*patent*, - - - 30
Telescopes, first invention of - - - 41
Tempering metallic wires, - - - 285
Thorp's running cap spinner, - - - 219
Tobacco by anthracite, drying - 5
Tubes of lead, &c. casting—*patent*, - - - 136

V

Vapours, exhaling and condensing—*patent*, - - 140
Vessels, mode of constructing—*patent*, - - 132
———— screw for propelling—*patent*, - - 181
————, &c. construction of—*patent*, - - 260

W

Washing rags—*patent*, - - 127
——————, machine for—*patent*, - - 348
Water discharge of under water, - - 69
———— proof, rendering articles—*patent*, - - 131
———— in boilers, on the height of - - 145
———— power, report of committee on - 73, 147, 221, 296, 367
Wax, improved sealing—*patent*, - - 199
Wheels, bent axles and dished - - - 96
———— for locomotive engines, on - - 352

PAGE.
Why and Because, the Plain . . . 418
Wires, on tempering metallic 285
Woad, madder and barilla, on . . 208
Woollen cloths, &c. dressing—*patent*, . . 180
Working man's Companion, Part 1, . . 214
Wrought and cast iron, durability of . . . 281

END OF VOL. VIII.

ADDRESS

OF THE

COMMITTEE ON PREMIUMS

AND

EXHIBITIONS

OF THE

Franklin Institute of the State of Pennsylvania,

FOR THE

Promotion of the Mechanic Arts.

WITH

A LIST OF THE PREMIUMS

OFFERED TO COMPETITORS AT THE EXHIBITION TO BE HELD IN OCTOBER,
1831.

PHILADELPHIA:
J. Harding, Printer, 36 Carter's Alley.

1831

ADDRESS.

To the Manufacturers and Mechanics of the United States.

The Committee on Premiums and Exhibitions of the "Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts," inform the manufacturers, mechanics, and artizans of the United States, that the seventh exhibition of American manufactures will be held in the city of Philadelphia, on the 4th, 5th, 6th, and 7th of October, 1831, to which all persons are invited to send the products of their skill, ingenuity, and industry.

In order that the happy results which have attended former exhibitions may be secured for the one now announced, the Committee have determined to pursue the same system, with such modifications as increased experience leads them to believe will be beneficial.

The annexed regulations have been adopted for the occasion, and to these the Committee invite the particular attention of all who wish to deposit their goods.

It will be seen that the list of premiums is more varied and extensive than on former occasions. This measure has been adopted with a hope that it would enlist a larger share of public attention, and add to the value and interest of the exhibition. The regulations have been framed to secure the fullest impartiality on the part of the judges, and, it is hoped, will enable the Committee to accomplish the arduous and delicate task of discrimination, with that success which has attended the exertions of their predecessors. This is the most difficult, and perhaps the only unpleasant duty attached to the exhibitions. But the liberal confidence of the public, as well as the good sense and candour of the depositors, have hitherto contributed to relieve the task from many of its asperities; and the Committee hope, that as their exertions will be equally strenuous, their measures will be viewed with the same kindness and liberality.

The Institute have no other object in their exhibitions, than the promotion of American manufactures, by encouraging and stimulating our artizans, by creating a wholesome competition between those employed in similar branches, and by arraying together all that can contribute to remove the unfounded prejudices that are entertained against American manufactures.

The Committee take the liberty of reminding competitors for premiums, that the real merit of otherwise valuable specimens of art is much diminished by the injudicious introduction of heavy mouldings and carvings, incongruous forms and unharmonious colours. Experience proves that a discerning public have hitherto expressed a decided preference for those productions which combine simplicity with elegance.

Whilst it is desirable that such articles should be exhibited as are calculated to display the high attainments of our mechanics, and which manifest the utmost skill and delicacy, it is considered as equally, and, indeed, more important, that those which are of universal consumption, and which are manufactured in large quantities, should also appear, and that these should be of the kind and quality which are ordinarily made.

WILLIAM H. KEATING,
SAMUEL J. ROBBINS,
JAMES RONALDSON,
M. W. BALDWIN,
FREDERICK FRALEY,
JOSHUA G. HARKER,
ALEXANDER FERGUSON,
J. HENRY BULKLEY.
Com. on Prem. and Exhibitions.

Published by order of the Board of Managers.

M. D. Lewis, *Chairman.*

W. Hamilton, *Actuary.*
Philadelphia, February 10, 1831.

REGULATIONS.

1. All articles intended for competition must be deposited, at latest, on Monday, the third of October, at twelve o'clock, (noon.)

2. The judges shall be appointed on the twenty-sixth of September, and a list of them published in one or more newspapers.

3. To insure perfect impartiality, the Managers, and all firms or partnerships in which Managers are interested, shall be excluded from competition, and no Committee shall award a premium or compliment to any of its members.

4. No premium shall be awarded for an article that has received one at any other public exhibition; and none can receive a premium that is not equal in quality to the best articles of similar manufacture, presented at former exhibitions.

5. Whenever the price is made a condition of premium, the makers must engage to furnish the required quantity at the price affixed.

6. Proof of origin must be furnished, if required, for every specimen offered for premium.

7. The managers reserve to themselves the privilege of withholding a premium, whenever the article is deemed not to deserve it.

8. Should articles of extraordinary merit be presented, the managers will with pleasure extend premiums to them, although not embraced in the annexed list.

9. A full report of the premiums awarded, and of the principal goods exhibited, as well as a catalogue of all others, shall be published immediately after the exhibition. The reports of the judges, or parts of them, shall be appended to the general report, with their signatures.

10. All goods intended for competition, must be accompanied by an invoice stating the price.

11. Arrangements will be made to exhibit to advantage any working models that may be sent in for exhibition, and the managers respectfully invite contributions in this branch. Experience has shown the interest which the public take in them; and the managers are impressed with a conviction that the display of them is calculated to convey useful information. A careful and competent superintendent will be provided.

LIST OF PREMIUMS.

1831.

1. To the person who shall manufacture in the United States, the greatest quantity of iron from the ore, during the year ending September 1, 1831, using no other fuel than anthracite, the quantity not to be less than twenty tons. *A Gold Medal.*

2. To the person who shall manufacture in the United States, the greatest quantity of iron from the ore, during the year ending September 1, 1831, using no other fuel than the bituminous coal, the quantity not to be less than twenty tons. *A Gold Medal.*

3. To the person who shall invent the best grate or stove for the consumption of anthracite in cooking and other domestic purposes, in small families, one hundred dollars and *A Silver Medal.*

The grate or stove must be better and cheaper than any now in use. Its price must be under fifteen dollars, and the maker must obligate himself to furnish any required number, (not exceeding fifty,) at the same price and of equal quality. No grate or stove shall be received for competition, in which the fumes resulting from the combustion of the anthracite are brought into contact with the food to be cooked.

4. To the person who shall invent the best grate or stove for purposes similar to the preceding, but applicable for large families, hotels, &c. *A Silver Medal.*

The conditions to be the same as in the above, except that the price is not limited, but the cost for which it can be made will be taken into consideration in determining the merit of the claims presented.

5. To the inventor of the best constructed furnace and boiler, superior to any now in use, for generating steam, with anthracite, *A Silver Medal.*

Certificates will be required of the furnace having been in use some time, of the quantity of coal consumed, and of the effect produced.

6. To the maker of the best mountain barometer, which shall combine portability with great accuracy and durability. The scale to be divided by the aid of a vernier into at least the two thousandth part of an inch; with thermometers attached to the instrument, and divided according to Fahrenheit's scale, at least into degrees. The

case for enclosing the barometer in travelling, should serve as a stand for it when in use. *A Silver Medal.*

7. To the maker of the best theodolite. *A Silver Medal.*

The instrument to be provided with an achromatic telescope, furnished with a sun shade, reading both in the horizontal and vertical planes, by means of verniers to 30 seconds. The horizontal circle numbered to 360°. The graduated circles or arcs, and verniers, to be of silver, and all the movements by tangent screws; the instrument to be provided with fixed eye glasses.

The principles governing the construction, the results from actual trial, the appropriateness of the alloys, the propriety in the strength of the different parts, the entire weight and portableness, and the workmanship generally will decide the premium for this instrument.

8. To the maker of the best level. *A Silver Medal.*

The spirit glass to be about 8 inches in length, with an erect achromatic telescope provided with a sun shade.

The considerations governing the award in this case to be similar to those for the theodolite. The facilities in making the adjustment, and their permanency being of primary importance in this instrument, these considerations will have a corresponding influence in making the award.

9. To the maker of the best surveyor's compass. *A Silver Medal.*

The needle to be about six inches in length. The graduations to extend to half degrees, and without any apparatus to compensate for the variation. The compass box to be without letters, or even the *fleur de lis*, though the cardinal points should be represented by lines. The instrument to be provided with the tripod staff. The considerations determining the awards for the theodolite and level will decide the merits of this instrument.

10. To the maker of the best levelling staff. *A Silver Medal.*

The staff to be of wood, armed with shoes; graduated decimally, and to read by a vernier to the thousandth part of a foot; the least and greatest height the staff is capable of designating—the wood ensuring sufficient strength without inconvenient weight and liability to warp—and the facility and accuracy in use are the considerations which will govern the award in this case.

It is recommended that until the premiums on Nos. 7, 8, 9, and 10, are awarded, the makers' names be omitted from the instruments. Should these four premiums be awarded to the same maker, then, instead of giving him the four silver medals, he shall be entitled to *A Gold Medal.*

11. To the maker of the best rifle gun, iron mounted, with percussion lock and double triggers, to carry a ball of from 25 to 35 to the pound, and not to exceed $20 in price. *A Silver Medal.*

12. To the maker of the best rifle gun, with percussion lock and double triggers, to carry a ball of from 50 to 75 to the pound.
A Silver Medal.

No limitation being fixed to the price of the rifle in this premium, it is to be understood that in the award of it, the beauty as well as the excellence of the workmanship will be considered.

13. To the maker of the best double barreled fowling piece with percussion locks. *A Silver Medal.*

14. To the maker of the best oil from cotton seed, not less than one hundred gallons to be made. *A Silver Medal.*

15. To the maker of the best vegetable oil that will answer as a substitute for olive oil. It must be free from flavour. Not less than one hundred gallons to be made. *A Silver Medal.*

16. To the manufacturer of the the best margaric candles, not less than one thousand pounds to be made. *A Silver Medal.*

17. To the manufacturer of the best specimens of isinglass or fish glue, not less than twenty pounds in sheets to be exhibited.
A Silver Medal.

18. To the maker of the best ordinary glue, such as is used by cabinet makers, hatters, bookbinders, printers, &c. *A Silver Medal.*

The premium to be awarded for its fitness for all the above mentioned purposes.

19. To the maker of the best white vellum quarto post paper, made from the best No. 1 domestic rags, weighing not less than 8 lbs. per ream. Not less than one hundred reams to be made, and ten reams to be exhibited. *A Silver Medal.*

20. To the manufacturer of the best specimens of porcelain.
A Silver Medal.

The specimens to constitute a tea set of not less than seventy-two pieces. In awarding this premium, the texture of the ware, its colour, painting, gilding, and the elegance and tastefulness of the forms will be taken into consideration.

21. To the manufacturer of the best dinner set of blue and white China, of not less than one hundred and twenty pieces.
A Silver Medal.

The same considerations as in the preceding will influence the award of this premium.

22. To the maker of the best and most extensive variety of cut glass. *A Silver Medal.*

In awarding this premium, the judges will determine whether the glass is transparent and colourless, free from flaws or air bubbles—the forms tasteful and symmetric—the cutting regular and chaste—and the specimens combining most of these qualities in the greatest variety of pieces, shall be deemed the best.

23. To the maker of the best constructed lamp for illuminating the streets of a city. *A Silver Medal.*

24. To the maker of the best and most extensive variety of mantel, astral, or hanging lamps. *A Silver Medal.*

In the award of this premium, due regard will be paid to the construction of the lamp in all its parts—to propriety and elegance of form—and to the excellence of the workmanship in every respect.

25. To the maker of the best sideboard, to combine usefulness as well as beauty. *A Silver Medal.*

26. To the maker of the best ladies' cabinet secretary and book case, of wood, the growth or produce of the United States. *A Silver Medal.*

27. To the maker of the best set of cabinet chairs and sofa to match; not less than 12 chairs and one sofa to be exhibited, all of wood the growth and produce of the United States. *A Silver Medal.*

28. To the apprentice who exhibits the best specimen of his own work in mortising and tenoning wood, not less than 12 mortises and tenons to fit together, also six veneered columns, suitable for bureaus or sideboards. *A Silver Medal.*

No premium will be awarded for the cabinet ware unless the design be chaste and elegant, and the workmanship equal to the best exhibited on former occasions.

29. For the best cast iron hollowware, tinned inside, for culinary purposes, to be equal to the best British goods of the same description, not less than one dozen pieces to be exhibited. *A Silver Medal.*

30. For the best brass battery kettles, equal to those made in Great Britain, not less than one dozen to be exhibited. *A Silver Medal.*

31. For the best bell metal kettles, not less than one dozen to be exhibited. *A Silver Medal.*

32. For the best iron wire of assorted numbers, from 7 to 25, not less than 200 lbs. to be exhibited. *A Silver Medal.*

33. For the best brass wire of assorted numbers, from 7 to 25, not less than 200 lbs. to be exhibited. *A Silver Medal.*

34. For the best card wire of assorted numbers, from 30 to 35, not less than 200 lbs. to be exhibited. *A Silver Medal.*

35. For the best cast steel hand and pannel saws, 26 inches long, not less than one dozen of each to be exhibited. *A Silver Medal.*

36. For the best cast steel iron back saws assorted, from 10 to 18 inches long, not less than two dozen to be exhibited. *A Silver Medal.*

37. For the best tea set of silver plated goods. *A Silver Medal.*

38. For the best set of table cutlery, to consist of not less than 51 pieces. *A Silver Medal.*

39. For the best anvils, equal to the mouse hole anvils, assorted from 1 to 2 cwt. not less than five anvils to be exhibited. *A Silver Medal.*

40. For the best japanned tea trays, the japanning to be done upon American sheet iron, not less than six trays to be exhibited. *A Silver Medal.*

41. For the best bar iron, from 2 to 5 inches square, and round iron from 2 to 5 inches in diameter, not less than 5 tons of each to be made, and 5 cwt. of each to be exhibited. *A Silver Medal.*

42. For the best cast steel of assorted sizes, not less than 2 cwt. to be exhibited. *A Silver Medal.*

43. For the best sheet iron, equal to that made in Russia, not less than 24 sheets to be exhibited. *A Silver Medal.*

44. For the best cast steel files, from 6 to 14 inches in length, one dozen of each, rough, bastard and smooth cut, to be exhibited. *A Silver Medal.*

45. For the best smiths' vices, equal to those known by the name of tower vices, not less than five to be exhibited, and to weigh from 30 to 80 lbs. *A Silver Medal.*

46. For the best trowels for the use of stone masons, bricklayers, and plasterers, not less than twelve of each to be exhibited. *A Silver Medal.*

47. For the best sample of drab and olive bang-up cord and velveteen, not less than two hundred yards to be exhibited. *A Silver Medal.*

48. For the best sample of green and red canton flannel, not less than twenty-six inches wide, and two hundred yards to be exhibited. *A Silver Medal.*

49. For the best sample of white canton flannel, twenty-six inches wide, not less than two hundred yards to be exhibited, and to be superior to any before offered. *A Silver Medal.*

50. For the best sample of $\frac{6}{4}$ cambric muslin, made of yarns from number forty to one hundred and twenty, not less than five pieces of twelve yards each to be exhibited. *A Silver Medal.*

51. For the best sample of $\frac{6}{4}$ book muslin, made of yarns from No. one hundred to two hundred, not less than five pieces, of ten yards each, to be exhibited. *A Silver Medal.*

52. For the best sample of plain and figured laces and lace veils, to be exclusively of American manufacture. *A Silver Medal.*

53. For the best sample of furniture chintz, not less than four colours, and not less than five pieces of twenty-eight yards each, to be exhibited. *A Silver Medal.*

54. For the best sample of rich chintz prints, for ladies' dresses, not less than three colours, and not less than five pieces of twenty-eight yards each, to be exhibited. *A Silver Medal.*

55. For the best sample of single coloured prints, the price not to exceed eleven and a half cents per yard, not less than five pieces, of twenty eight yards each, to be exhibited. *A Silver Medal.*

56. For the best sample of single or two coloured prints, the price not to exceed fifteen cents per yard, not less than five pieces of twenty-eight yards each, to be exhibited. *A Silver Medal.*

57. For the best sample of two blue prints, not less than five pieces of twenty-eight yards each, to be exhibited. *A Silver Medal.*

58. For the best sample of printed cotton handkerchiefs, not less than ten dozen to be exhibited, and to measure square. *A Silver Medal.*

Colours of all printed goods to be permanent.

59. For the best sample of plain chintz or coloured cambrics, some of which to be pink, light blue, green, and yellow, not less than ten pieces to be exhibited. *A Silver Medak*

60. For the best sample of $\frac{4}{4}$ fancy gingham in imitation of the Scotch, of yarn No. 45 or upwards, not less than ten pieces of stripes and checks of equal lengths, to be exhibited. *A Silver Medal.*

61. For the best sample of indigo blue checks, not less than one hundred and fifty yards to be exhibited. *A Silver Medal.*

62. For the best sample of pantaloon stuffs $\frac{3}{4}$ to $\frac{7}{8}$ wide, all cotton, or cotton and wool, not less than two hundred yards to be exhibited. *A Silver Medal.*

63. For the best sample of ladies' white cotton hose, not less than five dozen to be exhibited, and to be put up as well as the imported article. *A Silver Medal.*

64. For the best sample of ladies' black worsted hose, not less than two dozen to be exhibited, and to be put up as well as the imported article. *A Silver Medal.*

Silks.

65. For the best sample of sewing silk, blue, black, and assorted colours, not less than five pounds of sixteen ounces each, to be exhibited, to be put up after the manner of the Italian. *A Silver Medal.*

66. For the best sample of silk hosiery, not less than one dozen to be exhibited. *A Silver Medal.*

67. For the best sample of black and white silk gloves, not less than one dozen pair of each colour to be exhibited. *A Silver Medal.*

68. For the best sample of printed silk pocket handkerchiefs, to measure square, not less than three pieces, of seven handkerchiefs each, to be exhibited. *A Silver Medal.*

N. B. The material and manufacture of all silk goods to be exclusively American.

69. For the best specimen of full blue satinett, indigo dye, to measure at least twenty-eight inches wide, and not less than five pieces to be exhibited. *A Silver Medal.*

70. For the best specimen of fancy mixed satinett, to measure at least twenty-eight inches wide, and not less than five pieces to be exhibited. *A Silver Medal.*

71. For the best sample of satinett, the price not to exceed sixty-five cents per yard, and not less than five pieces of different colours to be exhibited. *A Silver Medal.*

72. For the best sample of blue, black, and fancy, single or double milled cassimeres, all to be permanent colours, not less than five pieces to be exhibited. *A Silver Medal.*

73. For the best sample of superfine blue or black cloth, permanent colours, not less than sixty inches wide, and exclusively of American manufacture. *A Silver Medal.*

74. For the best sample of blue cloth, indigo dye, to measure not less than fifty-four inches wide, price not to exceed three dollars per yard, and not less than forty yards to be exhibited.
A Silver Medal.

75. For the best sample of fancy coloured cloth, to measure not less than fifty-four inches wide, and not less than forty yards to be exhibited. *A Silver Medal.*

76. For the best sample of milled drab cloth, to measure not less than forty-five inches wide, price not to exceed one dollar and fifty cents per yard, and not less than fifty yards to be exhibited.
A Silver Medal.

77. For the best samples of red and green baize, not less than one hundred yards to be exhibited. *A Silver Medal.*

78. For the best sample of fine white gauze flannel, not less than three pieces of forty-six yards each, or six half pieces of twenty-three yards each, to be exhibited. *A Silver Medal.*

79. For the best sample of worsted stuff goods, coloured or black, not less than one hundred and twenty yards to be exhibited, and if bombazetts, to be in pieces of twenty-eight yards each.
A Silver Medal.

80. For the best sample of ingrain carpeting, thirty-six inches wide, not less than sixty yards to be exhibited. *A Silver Medal.*

81. For the best sample of Venetian carpeting, twenty-seven or thirty-six inches wide, not less than sixty yards to be exhibited.
A Silver Medal.

82. For the best sample of Brussels carpeting, not less than forty yards to be exhibited. *A Silver Medal.*

83. For the best sample of straw bonnets, if superior to any before exhibited. *A Silver Medal.*

84. For the best sample of three point blankets, in imitation of the Mackinaw blankets, to measure not less than six feet six inches long, by five feet six inches wide, to weigh at least eight pounds six ounces per pair, two pair to be exhibited. *A Silver Medal.*

The stripe and point marks to be clear indigo blue.

85. For the best bed blankets, either rose or whitney, to measure at least $^{10}/_{4}$ wide, by $^{13}/_{4}$ long. *A Silver Medal.*

86. For the best cotton blankets, at least twelve pair to be exhibited. *A Silver Medal.*

87. To the manufacturer of the best specimen of linen shirting, to be equal to the Irish, not less than fifty yards to be exhibited. *A Silver Medal.*

88. For the best specimen of leather in imitation of Russia, one dozen skins to be exhibited. *A Silver Medal.*

89. To the manufacturer of the best plate glass, not less than fifty square feet to be exhibited. *A Silver Medal.*

UNIVERSITY OF MICHIGAN
3 9015 06716 8131

B 430575 DUPL

BOUND BY
TURNER HAMILTON,
BOOK BINDER,
Hall Franklin Institute,
15 S. Seventh St,
PHILADELPHIA.